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Maintenance of Speech in Parkinson's Disease: The Impact of Group Therapy

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Abstract

The maintenance of communication in Parkinson's disease (PD) requires a long term management plan, due to the progressive nature of the associated communication deficits. While intensive behavioural treatment has been demonstrated to improve speech intelligibility in PD, the effects can decrease over time. People with PD also experience changes in their ability to participate in conversation and everyday communication. Methods to maintain communication after a primary speech treatment are of interest to clinicians and people with PD. The overall aim of this research was to investigate the outcomes of group therapy as a maintenance strategy following the Lee Silverman Voice Treatment (LSVT LOUD®).

A group therapy program (Loud and Proud) was developed according to current theories of neurorehabilitation, and the principles of LSVT LOUD®. The program was designed to target vocal loudness (a critical component of the LSVT LOUD®) and known areas of difficulty experienced by people with PD, including participating in group conversations, speaking in the presence of cognitive competition, and speaking over background noise.

Study 1 involved a Phase I pre-post intervention research design. The aims of this study were to determine the perceptual and acoustic speech outcomes following Loud and Proud; explore the effects of group therapy on communicative effectiveness and quality of communication life; pilot and refine the treatment protocol; and explore the impact of dysarthria severity on treatment outcomes. Four women and eight men diagnosed with PD and hypokinetic dysarthria participated in the research. The participants' average age was 70.42 years (range 60 – 76; *SD* = 5.15). The mean time since diagnosis of PD was 7.83 years (range: 2 – 16 years; *SD* = 4.53). An average of 2.06 years (range: 0.25 – 3.75 years; *SD* = 1.25) had elapsed since the participants had completed the LSVT LOUD®. Four participants presented with a mild dysarthria, five with mild-moderate dysarthria, one with moderate dysarthria, and the other two participants demonstrated moderate-severe dysarthria. Participants were assessed twice on separate days pre- and post-intervention across a range of perceptual and acoustic parameters, and communication and quality of life scales. Following baseline assessments, participants completed eight 90-minute group therapy sessions, delivered once per week. Participants were assigned to one of four Loud and Proud groups.

Measures of sound pressure level (SPL) in sustained vowel production, reading, monologue, and conversation, maximum frequency range, duration of sustained vowel, paired perceptual comparisons of intelligibility, partner-rated communicative effectiveness

(a modified version of the Communicative Effectiveness Index; CETI) and participant-rated communication quality of life (Quality of Communication Life Scale; QCL) were compared pre- and post-Loud and Proud. Participants demonstrated a statistically significant increase in SPL for conversation (2.20dB; $p = 0.027$), monologue (2.39dB; $p = 0.015$), reading (1.94dB; $p = 0.026$) and in sustained vowel production (1.88dB; $p = 0.042$) following the intervention. However, average SPL in conversation remained low following intervention (65.66dB). Maximum frequency range and duration of sustained vowel production did not significantly improve ($p = 0.950$; $p = 0.304$). Improvements in perceptual ratings of intelligibility and the CETI were not statistically significant ($p = 0.051$; $p = 0.091$). Participant ratings on the QCL did not demonstrate a significant change (-0.10, $p = 0.35$). There was heterogeneity in the participants' response to Loud and Proud that was not explained by dysarthria severity. Refinements to Loud and Proud were recommended following this Phase I study, to better target intelligibility, communicative effectiveness, and QOL.

In Study II conversational data from a purposeful sample of six participants in Study 1 were examined using a mixed-methodology. Recorded conversations between the PD participants and the researcher obtained before and after the Loud and Proud intervention were investigated using Conversation Analysis (CA) as the primary methodology. Descriptive quantitative analyses of occurrences of overlap, repair and topic initiation followed and allowed comparison of the communicative behaviours of the participants with PD and the communication partner across time. Analysis of the conversations revealed that the participants with PD made a greater contribution to the topics of the conversations after the intervention, and instances of repair resulting from difficulties understanding the talk of the participants were less common. The initiation of repair in association with reduced speech intelligibility increased with dysarthria severity, and communication partner's tolerance of silence varied.

This study provided initial findings related to evaluation of the Loud and Proud group therapy program and intervention outcomes for people with PD who had previously completed LSVT LOUD®. This research provides some evidence to suggest that group therapy following LSVT LOUD® may effect a change in specific speech parameters and aspects of communicative function in people with PD. However, further research is required in order to establish the efficacy of this intervention in relation to a revised protocol, optimal dosage, and alternative modes of service delivery.

Declaration by author

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No publications.

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No publications included.

Contributions by others to the thesis

The concept of researching the use of group therapy as a maintenance strategy following the Lee Silverman Voice Treatment belongs to Professor Theodoros.

A/Prof Davidson significantly contributed to the verification of Conversation Analysis in Chapter 4.

Both Prof Theodoros and A/Prof Davidson provided guidance in the development of the research plan and editing for drafts of all chapters of this thesis.

Statement of parts of the thesis submitted to qualify for the award of another degree

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Keywords

Parkinson disease, hypokinetic dysarthria, group therapy, maintenance, speech pathology, conversation analysis.

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Abbreviations Used In Thesis

AAC	Augmentative and alternative communication devices
CA	Conversation analysis
CAPPCI	The Conversation Analysis Profile for People with Cognitive Impairment
CETI	Communicative Effectiveness Index
DAF	Delayed auditory feedback
dB	Decibels
DBS	Deep brain stimulation
EMG	Electromyography
fMRI	Functional magnetic resonance imaging
ICC	Intraclass correlation
ICF	International Classification of Function, Health and Disability
LSVT LOUD®	The Lee Silverman Voice Treatment®
MMSE	Mini-Mental State Examination
MRI	Magnetic Resonance Imaging
MSPPARC	Modified version of the Supporting Partners of People with Aphasia in Relationships and Conversation
PD	Parkinson disease
PET	Positron emission tomography
QCL	ASHA Quality of Communication Life Scale
RHD	Right hemisphere disorder
SLP	Speech-language Pathologist
SP	Independent reviewing speech pathologist's initials (Study II)
SPL	Sound Pressure Level
UPDRS	Unified Parkinson Disease Rating Scale
VOCA	Voice-output communication aid

1. Introduction

Parkinson's disease (PD) is a chronic and progressive neurological condition. It is the second most common neurological condition in Australia, following dementia. [1,2] There were an estimated 54,700 people with PD in Australia in 2005 and it is predicted that 98,500 Australians will have PD in 2025. [1] In 2011, it was calculated that one in 350 Australians were living with PD. [2] PD is surprisingly prevalent; for example, in Australia, the diagnosis of PD is more common than lymphoma and leukaemia, and prostate cancer.[1] In people over 55, the prevalence of PD is higher than that of breast cancer, colorectal, stomach, liver and pancreatic cancer. [1] The prevalence of PD in Australia is expected to increase due to demographic aging. [1,2]

People live with PD for an extended period of time, the median time from diagnosis to death being 12.2 years in Australia. [1,2] Consequently, the financial costs of PD mount each year, including healthcare costs, costs of care, and loss of wages and productivity. It was estimated that the cost to the Australian healthcare system alone was $478.5 million in 2011, averaging $7,599 per person with PD for the year. Half of this cost was for residential care. [2] Likewise, the ongoing non-financial cost of PD is significant, and includes pain, suffering and premature death. These costs are borne by people with PD, their families and society. [1-3]

1.1.1 The neuropathology of PD.

The symptoms of PD result from preferential degeneration of the substantia nigra's dopaminergic neurons together with the appearance of Lewy bodies – proteinaceous intracellular inclusions. [4] It has been estimated that 60 to 70% of the substantia nigra's dopaminergic cells have degenerated before the onset of PD symptoms. [5] Although the substantia nigra is the primary site of damage in PD, other sites in the brain can also be affected, including the norepinephrine neurons in the locus ceroeleus, cholinergic neurons in the nucleus basalis of Meynert and dorsal motor nucleus of the vagus, serotonin neurons in the dorsal raphe nucleus, and neurons of the cerebral cortex, brain stem, spinal cord, and peripheral autonomic nervous system. [4,6] The death of dopamine-containing cells of the substantia nigra results in the classical symptoms of PD: hypokinesia, bradykinesia, rigidity and rest tremor. [7]

1.1.2 Neuropathology and communication in PD.

An understanding of the neurological changes responsible for communication impairment in PD has evolved over time. Early researchers hypothesised that the dysarthria associated with PD could be attributed to the classical PD symptoms, and was of the same nature and origin as deficits apparent in the limbs. [8] The potential influence of non-doperminergic pathways on the production of speech in addition to doperminergic pathways, [9] however, could explain the limited response of speech to medications. [10] Axial symptoms, including dysarthria, have been attributed to an increase in abnormal activity in non-doperminergic areas, which would account for the continued progression of symptoms after limb function has been addressed with levodopa therapy. [11,12] Cognitive-linguistic deficits in PD have been an increasing focus of the literature in recent times. [13] The substantia nigra is central to the frontostriatal circuitry, linking cortical and subcortical structures, including areas associated with movement and cognition. [13] Disruption to the frontostriatal circuitry, can occur early in PD, [14] disrupting executive functions crucial to active participation in conversation, including attention and working memory. [15] Disruption to the circuit involving the dorsolateral prefrontal cortex has been implicated as a primary source of cognitive-linguistic disruption in PD. [15]

1.1.3 Communication Disorders in PD.

Over 70% of people with PD present with a speech disorder, and nearly one third cite dysphonia as their most debilitating deficit, with the incidence and severity of the disorder increasing with disease progression. [16] The World Health Organisation's International Classification of Function, Health and Disability (ICF) provides a framework for description of human functioning and disability. [17,18] The ICF describes the dynamic interaction between the domains of body structure and function, activity and participation. [17,19] These domains influence and are influenced by health conditions and environmental and personal factors. [17] At the body function and structure level, the dysarthria associated with PD is the result of physiological and neuro-anatomical change. [20,21] The ICF provides a common language for discussing functioning and disability associated with PD and provides a structure to use when reporting outcomes. [19]

A major consequence of dysarthria for the person is reduced speech intelligibility. [20] Intelligibility in the speech of people with PD has primarily been studied at the activity level, in single word, sentence, and monologue tasks in the laboratory or in clinical settings. [8,20,22-24] Intelligibility cannot be quantified absolutely, however, but must be considered relative to the environment, speaker factors, recipient factors, and task [25] under which the assessment was made. [20,25] It is likely that people with communication disorder are most

interested in communication as it relates to their ability to participate in their everyday lives. [19,26] Speech-language pathology research and clinical practice should address the ability of the person with a communication disorder to function and participate with friends, family and their community. [26] The nature of the activity and participation of people with communication disorders and the contextual factors influencing communication are under-represented in the literature, [26] but are crucial to determining appropriate therapy targets and the real life impact of interventions.

In addition to dysarthria, most people with PD will also experience cognitive-linguistic dysfunction, including those who do not have dementia. [13,27] The communication disorders associated with PD impair the individual's capacity to communicate in social and vocational situations. This deterioration in communication has a significant negative impact on quality of life, leading to social and emotional isolation within the immediate family and the community, [28] and can restrict or preclude continued employment, especially for those who work face-to-face with the public. [1,29]

People with PD perceive a negative change to communication even before obvious changes to intelligibility or motor status are apparent. [30] In a study by Miller et al., [30] one hundred and four participants with PD completed a battery of speech and voice assessments and a questionnaire relating to perceptions of change. Primary communication partners were also invited to complete the questionnaire, and 45 partner-completed forms were available for analysis. The participants with PD experienced a loss in their control of communication, had less confidence and found it more difficult to get their message across than before their diagnosis. This resulted in feelings of frustration, inadequacy, and loss of independence. Communication partner responses mirrored those of the PD participants, although in general their ratings were more positive, both before and after diagnosis. [30] The impact of these changes on quality of life was substantial. Thirty-seven people with PD, participated in interviews. [31] The participants identified changes to voice, articulation and language ability, and four themes emerged from the data about the effect of these changes – altered interactions with others, problems in conversation, feelings about reduced intelligibility, and changes to voice. The participants' main concern was not the nature of the speech, voice and language changes, but rather their impact on self-concept, family dynamics, and participation in social life both within and outside the family. [31] Given the impact of communication disorder on the quality of life of people with PD, and the extended period of time that people live with PD, management of communication impairment is required for the lifespan of the person with PD. [1,3]

1.1.3.1 Dysarthria and PD. Hypokinetic dysarthria, a motor speech disorder, is the disturbance of multiple interacting subsystems involved in the production of speech. [9,32,33] The classical symptoms of dysarthria in PD include reduced loudness, hypoprosody, hesitation, harshness, huskiness or breathiness, and imprecise articulation. [24,34] Specifically, perceptual evaluation, acoustic and physiological assessments of people with PD have revealed impairments in prosody, phonation, articulation, respiration and resonance. [21]

1.1.3.1.1 Prosody. Prosody is the aspect of speech most affected by hypokinetic dysarthria. [24,34] People with PD present with speech that is monotonous in pitch and loudness, with reduced stress. [24,34,35] Rate disturbances include episodes of short rushes of speech, [8,34] and an overall rate that can be variable, too fast or too slow [24,36,37]. Prosodic deficits are likely to be the result of the laryngeal and respiratory impairment reported in acoustic and kinematic studies, [24] as outlined below.

Studies investigating speaking rate have returned contradictory findings, indicating that some PD participants have either a faster or slower speech rate, [38-41] or alternatively demonstrate no difference in speech rate [42,43] when compared with healthy controls. [44] Rate appears to be variable in PD, and findings of no difference may be the result of group means not reaching a statistically significant difference due to the negating effects of faster and slower participants. [39,40,44,45] Variability in task type (for example reading, conversation, and repetition) across studies could also partly explain the disparate findings, particularly given that a number of studies noted differences in speaking rate for PD participants depending on the task. [44] Studies of pauses in the speech of PD participants also vary, with some finding increased duration or frequency of pauses, [39,40,46] and others finding no difference in comparison with control participants. [38,47] The inclusion of pauses in samples may also affect measures of rate. [44]

1.1.3.1.2. Phonation. Dysarthrophonia is common in people with PD, with 89% of a sample of 200 people with PD presenting with laryngeal dysfunction. [48] The features of the dysphonia in PD are described by expert listeners as harshness, breathiness, tremor, and a habitual pitch that is lower or higher than normal. [24,34,36,38] Dysphonia can present very early in the disease process, and frequently precedes articulation deficits. [48]

While some earlier studies found there was no significant difference between group means for Sound Pressure Level (SPL) for PD and control participants, [36,40] more recent research has suggested that vocal SPL is reduced by two to four dB in people with PD compared with the healthy aged. [37,43,49,50] Thyroarytenoid muscle amplitudes on EMG were reported to be reduced in optimally-medicated PD participants and were associated with

reduced SPL. [51] Variability of intensity has also been reported to be reduced in PD, [52] particularly with severe dysarthria. [40]

Phase asymmetry, incomplete vocal fold closure phase and vertical tremor of the larynx during phonation have been observed on endoscopic and stroboscopic examination of the larynx in people with PD. [53,54] The incomplete closure of the vocal folds on phonation results in reduced vocal loudness and breathiness. [53,54]

Acoustic and physiologic measurements have supported the presence of impaired phonatory stability in PD. Electroglottography, and electromyography measures vary between people with PD and controls. [44,52,55] Individuals with PD demonstrated increased jitter and lower harmonic-noise ratio than control participants. [52,56]

There is disagreement within the literature surrounding fundamental frequency in PD, with some studies reporting higher fundamental frequency in PD. [37,52,57] and others suggesting that fundamental frequency in PD is comparable with the healthy aged. [40,58] It has been suggested that fundamental frequency could increase with increasing severity of the dysarthria, which may explain the disparate findings. [40] Fundamental frequency variation has been reported to be lower in PD than in the normal population, as has maximum fundamental frequency range. [40,52,55]

1.1.3.1.3 Articulation. Reduced articulatory precision occurs in nearly half the people with PD, [59] with stopped-plosive, fricative and affricate consonants being the most affected sounds. [48,59] Of the speech impairments in PD, articulation deficits are the most strongly correlated with reduced intelligibility. [8,24,35] Acoustic studies have revealed people with PD have shallower formant slopes [43] and impaired production of syllables with stopped consonants. [60]

Physiological studies have investigated the movement of articulators in speech and non-speech tasks, revealing differences in PD participants' velocity, speed, and amplitude of the lips, tongue and jaw when compared with control participants. In syllable repetition tasks, PD participants have exhibited reduced labial amplitude and velocity compared with controls at normal conversational speed, and exhibited reduced velocity as speed increased, unlike control participants. [61] When compared with healthy control participants, PD participants' lower lip velocity and amplitude in sentence production have been reported to be both comparable with [62] and reduced. [43]

In rapid syllable repetition, both dysarthric and non dysarthric speakers with PD exhibited similar range and speed of lingual movement; however, PD speakers with dysarthria had a longer duration of movement when compared with non-dysarthric speakers. [63]. Similarly, in sentences loaded with lingual sounds, PD participants with mild

dysarthria exhibited comparable range of lingual movement in alveolar production, and increased range for velar consonants to healthy control participants. [64] Further research is required to elucidate the exact nature and influencing factors in lingual distance travelled, duration of movement, coordination, and perception of imprecision for lingual sounds in dysarthric speakers with PD.

With regards to jaw movement, durations of non-speech jaw movement were found to be increased in PD participants compared with controls, and the ratio of peak velocity to movement amplitude was reduced. [65] Conversely, when producing syllables in isolation, the ratio of peak velocity to movement amplitude was comparable with controls, and when producing syllables embedded in a carrier phrase, the ratio was greater for PD participants than control participants. [65] People with PD also have demonstrated more variability in articulation performance, and longer response times than have their healthy peers. [66] This combination of variability with lengthier response times may reflect motor planning deficits. [66]

1.1.3.1.4. Respiration. There is evidence that respiratory support for speech in PD is reduced when compared with controls. Rib cage volumes are smaller and abdominal volumes larger during speech in PD, suggesting that airflow to the vocal tract is reduced. [41] Lower oral pressures have also been recorded in some PD participants. [41,67] Findings concerning the ability to sustain vowel production in PD, however, are equivocal, with some studies reporting deficits, [38,68,69] and others reporting no difference between PD and control participants. [49,56]

1.1.3.1.5 Resonance. A disturbance of resonance does occur in the speech of some people with PD, and although it is not a common feature of hypokinetic dysarthria, [48] it can be severe for some individuals with PD. [70] Across the range of disease severity, people with more severe PD have demonstrated greater hypernasality than do those with early stage PD as rated by expert listeners. [71] While not a hallmark of hypokinetic dysarthria, [48] resonance disturbance may occur in individuals with PD, [35,70-72] with subsequent deleterious effects on articulation and intelligibility.

Velopharyngeal dysfunction has also been detected in some speakers with PD. [44] Nasal airflow rates have been found to be higher r for PD participants than controls on syllable repetition tasks. [72] The speech performance of optimally-medicated people with PD in comparison to the healthy aged is an area that has been investigated with diverse laboratory measures and considerable variability in tasks. This context may explain some of the variable findings in the literature, as it has been suggested that speech performance varies according to task type. [73] It remains unclear to what extent the findings from the

clinical setting generalise to communication in the community. Speech in the naturalistic setting in PD is as yet unexplored. There is potential for future research to exploit portable technology to collect objective data, such as SPL and speech samples, from people with PD and the healthy aged in the context of daily living.

1.1.3.2 Cognitive-linguistic dysfunction and PD. Conversational competence requires the ability to store and process incoming information, to formulate and remember a response, to monitor for a place to take a turn, and to adapt to shifting topics and unexpected events, such as misunderstanding and interruption. In practice, this happens at high speed, and typical speakers demonstrate the ability to keep pause times to a minimum, with overlapping speech a frequent occurrence. [74] Communication in PD is affected by changes in cognition. [13] Due to the complex and close association between linguistic ability and other cognitive functions, these domains are not easily dissociated for assessment; as a result, the combined impact of cognitive and linguistic change is commonly explored and described as cognitive-linguistic interaction. [13,75] PD negatively affects the speed of information-processing and the ability to plan, sequence, switch sets, monitor ongoing action, and inhibit. [13,15,76-79] It is not surprising, then, that people with PD complain of difficulties engaging and keeping a place in conversation, even before the advent of obvious deterioration in intelligibility. [31]

1.1.3.2.1 Receptive high-level language. For people with PD, higher level language function is commonly impaired, particularly receptive language ability. [13,27] People with PD are reported to have difficulties in the comprehension of complex sentence structures, [80-82] detecting non-literal or implied meaning, [83-86] and decoding emotional cues such as facial expression and prosody. [87-89] These difficulties become greater with increased cognitive demand. [27,90]

Working memory deficits are reported to occur in PD, and have been implicated in the difficulties experienced by people with PD when decoding lengthy, complex sentences. [81,91,92] People with PD without dementia demonstrate intact syntactic ability in cognitively non-demanding tasks, but perform more poorly than controls on tasks that tax cognitive resources. [80,81] The changes in cognitive processing in PD have been explored with fMRI. When processing sentences that breach canonical word order, people with PD demonstrated less activation of the caudate nucleus, middle frontal gyrus, medial superior frontal gyrus, parietal lobule and inferior temporal gyrus. [92] Similarly, when processing sentences that required working memory, people with PD without dementia showed less activity in striatal, anteromedial prefrontal and right temporal regions than did healthy control participants, suggesting that impaired sentence processing was related to

disruption of a large-scale network allowing for recruitment and coordination of cognitive resources for sentence processing. [93] Additional activation was noted in cortical areas in PD, likely reflecting cortical compensation for working memory deficits. [93]

People with PD have deficits in comprehending nonliteral and pragmatic aspects of language compared with healthy controls. [83-86,94] Cognitive resources, including working memory, are believed to be essential for pragmatic language functioning, [83,95-98] and the ability to interpret inference, sarcasm, metaphor and irony is negatively affected by cognitive deficits in PD. [83,85,86,99] Pragmatic competence requires theory of mind (the ability to infer another's state of mind and predict their response) which is reported to be impaired in PD and to correlate with cognitive measures. [83,98,100]

While emotion-processing is reported to be impaired in PD, [87-89] the influence of cognition on emotion-processing is still a matter for debate within the literature. [87] It has been reported that emotional processing abilities in people with PD were predicted by the results on executive function testing [88,101]. In contrast, in another study results on emotion-processing assessment across visual, auditory, lexical and multi-modal conditions did not correlate with cognitive assessment results. [87] Similarly, the ability of people with PD in detecting speaker confidence from prosody was found to be independent from neuropsychological measures, although PD participants' ratings of speaker politeness was related to working memory. [84]

1.1.3.2.2 Expressive high-level language. Additionally, cognitive deficits have been reported to contribute to impairments in high level expressive language. [102] People with PD without dementia perform more poorly than control participants in semantic and phonemic verbal fluency tasks. [15,103] People with PD have been reported to have more difficulty accessing semantic information in definition tasks than do matched controls. [104] The notion of specific semantic deficits in PD, however, is controversial within the literature. [13] Ability in verbal fluency tasks is related to the ability to recall words within a category and to switch between categories, [105] and it has been noted that executive deficits may hinder the ability of people with PD to create categories and employ strategies. [13] The presence of depression can also exacerbate impaired verbal fluency performance. [106]

While people with PD are reported to speak as much as their healthy peers, in experimental tasks, people with PD impart less information and produce more grammatical errors than controls. [107] People with PD without dementia perform more poorly on tasks than controls requiring generation of definitions and recreating sentences. [104]

Cognitive status is related to expressive syntax in PD, but does not explain the deficits in their entirety. [108] In a verb cloze task, people with PD made more errors than did control subjects. [109] PD participants' errors increased with longer clause length and they over-applied past tense. [109] While PD participants' performance in the tasks correlated with working memory capacity, the PD participants' mean working memory was not significantly different from the controls'. [109] Set shifting was also correlated with accuracy, which accounted for the perseveration on past-tense. [109] At the sentence level, people with PD demonstrate poorer performance in repetition and generation tasks than matched controls. [104,108] When sentence repetition and generation was controlled for working memory and executive function with regression analysis, repetition longer differed between controls and PD participants. [108] However, sentence generation remained impaired for people with PD even when working memory and executive function were taken into account. [108] At the discourse level, the complexity of expressive syntax has been shown to decrease with increasing cognitive deficits and increasing severity of dysarthria, although group norms do not significantly differ between PD and control participants. [110] While cognition accounts for a large proportion of syntactic deficits in PD, there remains the possibility of a specific linguistic deficit affecting expressive syntax in PD.

Executive function, attention and memory are essential in conversation and communication. While the impact of cognition on language at the sentence level and in clinical tasks has been established, [82,97,99] the effects of cognitive-linguistic deficits on conversation behaviour in PD is relatively unexplored, particularly in the naturalistic setting and in multi-party situations. Given the importance of attention and memory in engaging in conversation, and that cognitive-linguistic deficits are present in PD, the interaction between cognitive-linguistic and conversational competence is an area in need of further research.

1.1.4 Current Treatment for Communication Impairment in PD

Axial symptoms, including dysarthria and cognitive changes, have proven largely resistant to pharmacological and surgical interventions, despite the proven efficacy on the cardinal features of PD. [10,24,44,111-113] Intensively delivered behavioural intervention has the strongest evidence base of the treatments for dysarthria in optimally medicated people with PD. [114] Research into the clinical assessment and intervention of cognitive-linguistic deficits in PD, however, is unexplored, with the existing literature instead focussing on rehabilitation of underlying cognitive skills. [115,116] It remains unknown whether behavioural intervention will improve cognitive-linguistic function for people with PD.

1.1.4.1 Behavioural treatments. Early opinions regarding behavioural intervention for hypokinetic dysarthria were pessimistic, [117,118] but the literature now contains ample evidence that hypokinetic dysarthria does respond to behavioural intervention. [117,119-122] Speech pathology intervention, in combination with an optimal medication regimen, is currently the most efficacious treatment for the dysarthria associated with PD. [10,44,112,123,124] In particular, there is evidence that the Lee Silverman Voice Treatment® (LSVT LOUD®) provides immediate post-treatment improvement, and there is evidence of long-term maintenance of the effect in the clinical setting. [122,125-127]

1.1.4.1.1 The Lee Silverman Voice Treatment®. The LSVT LOUD® was developed to treat the speech and voice disorders evident in people with PD. The program is standardised and intensive, with the participant attending 16 sessions of therapy – one hour per day, four days per week – across four weeks. [128] The treatment tasks are based on principles of motor learning and correspond to some of the proposed principles underlying neural plasticity, including intensity, complexity, saliency, early intervention, and ongoing activity to maintain function and avoid further deterioration. [129] Participants have one single cue, "loud", to increase vocal amplitude and loudness. Therapy involves modelling loudness and the use of visual and/or tactile cues to achieve the required volume. The simplicity of the cue is important, as extensive instructions are hypothesised to be too complex to use outside the clinic room. [130] Increasing vocal amplitude has been reported to be a simpler target than exaggerated articulation [131] or slowed rate, allowing the person with PD to use well-established movement organisation with a focus on one speech parameter rather than multiple articulators. [132,133] To increase generalisation to the naturalistic setting, clients with PD practise hierarchical speech tasks progressively approximating communication in the general setting. They engage in carry-over activities to encourage the treatment effect to extend beyond the clinic room. [130]

Data for the efficacy of the LSVT LOUD® is persuasive. The LSVT LOUD® has been compared both with alternative treatment (respiratory therapy) and with no treatment in randomised control trials, as well as comparing participants of the LSVT LOUD® with healthy controls. [120,122,134,135] Follow-up data is available to two years post-intervention. [122,134] Participants who complete the LSVT LOUD® significantly outperformed those randomised to the placebo or to the no treatment condition, both immediately following treatment and two years later. [122,134] Although the LSVT LOUD® targets increased loudness, pilot data suggests that the effects of the treatment extend to articulation, prosody, facial expression, and swallowing. [124,136,137] Functional imaging has revealed the effectiveness of the LSVT LOUD® in neural reorganisation, with changes to the right

hemisphere, basal ganglia, limbic system and prefrontal cortex reported post-treatment. [138-140]

While the LSVT LOUD® participants out-performed the respiratory and placebo group participants, their SPL did deteriorate over time across the assessment tasks. [114,122,134] This fading of treatment effect is unsurprising given the progressive nature of PD, and strategies to maintain speech and voice following the LSVT LOUD® warrant further investigation.

To date, the data supporting the LSVT LOUD® has been reported by one research group, in one country, from experiments completed in a controlled research environment. The use of a lottery for randomisation has been criticised, due to lack of concealment of allocation [141,142]. A greater proportion of men than women were recruited to the studies [120], limiting generalization to the broader population with PD [141,142]. Larger scale studies are required to determine the effectiveness and generalizability of the LSVT LOUD®. [141,142] Evidence pertaining to the clinical outcomes of the LSVT LOUD® when delivered as part of mainstream practice in the home environment, following intervention in the community health or hospital settings, is required.

1.1.4.1.2 Communication partner training. Communication partner training has been proposed as a possible intervention to improve the communication environment for people with PD. Forsgren and colleagues [143] describe a pilot study which used a modified version of the Supporting Partners of People with Aphasia in Relationships and Conversation (MSPPARC) for three men with PD and their spouses. The participants' satisfaction with the intervention was assessed, and ratings made for the PD participants' participation in conversation and the spouses' skill in supporting conversation from videoed conversation samples, before, during, immediately following, and nine weeks after intervention. The spouse participants reported that the MSPPARC had been helpful. Two of the dyads reported small improvements in communication following the intervention. SLP ratings did not reveal changes to participation of the people with PD or spousal skills in supporting the conversation. The assessments used were modified from those used in the stroke population, and may not be sensitive to the population with PD. Interestingly, the authors elected to assess the executive function of the spouse, but relied on verbal fluency to assess the cognition of the person with PD. A future study is underway that will include more participants and a cognitive battery for the PD participants which may help determine the best candidates for communication partner training. [143] It is also possible that communication partner training may need to be made more specific for people with

PD, and research is required to determine the behaviours of communication partners that hinder and assist people with PD to participate in communication.

1.1.4.2 Directions for future research. Further investigation is required into long-term behavioural management of the communication disorders associated with PD. While the evidence for the efficacy of the LSVT LOUD® is convincing, outcomes have been measured only in the laboratory or clinical settings. There is a need for well-designed studies investigating carry-over of treatment effects into the community setting, and to the individuals' day-to-day communicative tasks and interactions. [144] There is also a need to determine efficacious interventions to maintain communication in PD over time, including participation in communication activities, cognitive-linguistic ability and speech intelligibility.

1.1.5 Maintenance of Speech Following Intensive Treatment

While treatment effects are evident for up to two years following the LSVT LOUD®, SPL does reduce over time. [122] It is essential to ensure treatment plans include methods to maintain speech over the life-span of the client, given the chronic and progressive nature of PD. [3,130] Intervention also needs to be extended to target pragmatics and the cognitive-linguistic skills required to participate in conversations. Given the concerns raised by people with PD about social withdrawal, embarrassment and loss of confidence, intervention needs to extend beyond the impairment level to target the person with PD's activities and participation. [114]

1.1.5.1 Group therapy. The use of group therapy as the primary treatment of dysarthria and dysphonia in PD has drawn criticism, as it does not allow for individual clients to work to their maximum effort level for the entire session. [129] That being said, continued exercise and follow-up is required to maintain speech as PD progresses, and initial studies into group therapy for dysarthria in PD have returned promising results for its use as a maintenance strategy.

1.1.5.1.1 Group therapy to supplement individual intervention. Manor, Posen, Amir, Dori and Giladi (2005) described a group treatment program for patients with PD who had previously undertaken individual therapy. As in many situations, financial constraints resulted in a limitation of services to their clients, with a subsequent inability to provide daily, individual therapy, resulting in decreased clinical effectiveness of the program. The authors attributed reduced client motivation to practice techniques and reduced generalisation of treatment targets to the service limitations. The clinicians' response was the instigation of group therapy as a follow-up to individual therapy. There were significant improvements in turn-taking and initiation counts, self-rated perception of

clarity, and frequency range. Although five of the eight participants improved on the measurement of amplitude range, the mean increase failed to reach significance, which may have been due to the small sample size. However, there was no control group for this study, making it unclear if the treatment resulted in the improved scores or if it was the result of improved socialisation, or a Hawthorne or placebo effect.

1.1.5.1.2 Group therapy as a primary intervention for PD. Sullivan, Brune, and Beukelman [145] reported that a group intervention for six patients with PD and their spouses resulted in improved speech performance in five of the six participants, with some improvements maintained for up to ten months post-treatment. Their treatment consisted of eight sessions, delivered twice weekly, with the participant and some spouses attending. The participants were given a video of the group practising the techniques for home practice following the conclusion of the program. Each of the sessions targeted a communication strategy including: increased breath support and projection; precise articulation; improved phrasing and intonation; use of "communication-enhancing techniques"; strategies and education for families; and promotion of generalisation outside of the treatment sessions. The participants' intelligibility and rate were assessed using the Computerized Assessment of Intelligibility of Dysarthric Speech. [146] Perceptual ratings of the participants reading the "Rainbow Passage" [147] were completed by three speech pathologists, for tone, pitch, loudness and naturalness, and communication effectiveness was assessed using The Communication Profile for Speakers with Motor Speech Disorders. [148] Previous therapeutic input was not reported, and the group appeared to be intended to be part of the primary treatment rather than a maintenance strategy. Immediately post-treatment, improvements were reported in intelligibility, rate, and perceptual measures for five of the six participants, with improvements from baseline maintained for five to ten months. Following intervention, some participants reported improvements in their communication effectiveness, while others reported increased difficulty, perhaps due to the enhanced awareness of the impact of their dysarthria following the intervention. The size of the study was small and improvements were heterogeneous in nature and were reported participant-by-participant with no statistical analysis undertaken. There is subsequently limited ability to generalise the findings to the broader PD population.

De Angelis et al. [149] reported that 20 participants who completed 13 group sessions over one month (three times weekly) demonstrated statistically significant improvements in clinical measures of voice following intensive group therapy, and reported subjective improvements in communication and swallowing. The treatment program focussed on

vocal intensity and high effort, and used a “pushing” technique to facilitate glottis closure, where the participants were required to phonate (sustaining a vowel following a plosive consonant) while rapidly pushing their arms down from shoulder height to just below the hips. The therapists also cued for “over-articulation”. The evaluation session included measures of maximum phonation time of sustained vowels, the s/z ratio, airflow measures, and SPL when sustaining /a/ and when counting from one to 20 at habitual, minimal and maximal loudness. The participants also completed a self-evaluation via interview regarding communication and swallowing. Following the intervention, there was an increase in phonation times, decrease in the s/z ratio and airflow values, increased vocal intensity and decreased concern regarding dysphonia, monotony, intelligibility and dysphagia. The participants continued with maintenance sessions following the intensive treatment, and while the authors reported that these improvements were maintained, no data was available. The assessments were completed by the same therapist who completed the groups, which presents the risk of bias confounding the results.

In both of these studies of group therapy as a primary treatment approach, it was not stated whether the participants had previously undertaken speech pathology intervention for their dysarthria, and previous treatment was not an exclusion criterion. Therefore, it is not possible to say if the group therapy was a sufficient replacement for individual treatment, or whether the group intervention served to review or renew a previous treatment effect.

A more recent pilot study by Searl and colleagues [23] has contributed towards addressing this issue. Searl et al. employed [23] group therapy as an alternative intervention to the LSVT LOUD®. Fifteen participants with PD attended eight 90-minute group sessions over eight weeks. Prior completion of the LSVT LOUD® or other loud-focussed speech intervention was an exclusion criterion for participation. The group program used the exercises from the LSVT LOUD® protocol, adapted for the group environment. Following the intervention, the participants’ SPL and frequency range and maximum significantly increased. However, the authors noted that the gain in SPL was not as great as that reported in studies of the LSVT LOUD®, which may be attributable to reduced clinician feedback, reduced intensity within the session, reduced frequency of intervention, [23] or reduced ability of the participants to self-monitor in the group environment. The participants’ rating on the Voice Handicap Index was significantly reduced following the intervention. [150] On perceptual assessment by speech pathology students, 80% of participants were rated as louder post-intervention. Importantly, clinician and participant feedback indicated it was possible to complete many of the LSVT LOUD® activities in a

group format. There was no control group for these studies, leaving the possibility of a Hawthorne or placebo effect contaminating the results.

1.1.5.1.3 Future directions for research in group therapy. Studies describing group therapy for speech in PD have been limited, weak in research design, and have employed differing methodologies which preclude synthesis of results. There is a need for research into maintenance group therapy that is based on efficacious behavioural intervention – the LSVT LOUD® – which targets vocal loudness and the known areas of difficulty for people with PD, in particular, cognitive load and participating in group conversation. The trend appears to be that group therapy provides promise for maintaining the speech of people with dysarthria resulting from PD, especially when considering also the motivational and psychosocial benefits of group therapy. [23,145,149,151-154]

1.1.6 Compounding Factors Associated with Communication in PD.

While the speech impairment associated with PD has been investigated and described using multiple methodologies, research into its impact on the person with PD's activity and participation in society has only recently been reported. In the everyday life of people with PD, the main consequence of dysarthria is unintelligibility. [155] Compared with the quiet clinic-room setting, the naturalistic setting provides additional challenges with regards to background noise and listener familiarity. For some people with PD, communication is further compromised by concomitant cognitive deficits including difficulties completing two simultaneous tasks (dual-tasking), high level language deficits, and deficits in expressing and comprehending emotion intent. [142] Unsurprisingly, even before the onset of severe decline in intelligibility, people with PD report that their communication deficits negatively impact their feelings of confidence, adequacy, control, and ease of conveying their message, [156] and interactions with familiar communication partners can be affected. [157]

1.1.6.1 Background noise. Unlike the naturalistic setting, clinic and laboratory settings are typically sound-attenuated, with communication occurring in dyads. This artificial quietness may mask deficits in articulation and voice that are apparent with competing noise. Intelligibility is compromised by background noise in people with PD. [158] Leszcz (2012) compared single-word, sentence and conversational speech production of 10 people with PD with mild to moderate dysarthria with 10 control participants. The participants performed the tasks in three multi-talker background noise levels (no noise, 65 dB and 75 dB). Overall, all participants demonstrated a decrease in intelligibility with increasing noise, but intelligibility was significantly more affected by the presence of

background noise for PD participants than it was for control participants. In the no-noise condition, intelligibility scores were approximately 4-6% lower for PD participants, but were approximately 20-30% lower at 65 dB of background noise and 35-45% lower at 75 dB of noise. The impact of background noise in the everyday environments of people with PD needs to be considered when planning assessment and treatment of communication, particularly when considering the sensory impairments present in the population with PD.

1.1.6.2 Sensory impairment. The presence of sensory and perceptual deficits in people with PD is established in the literature. [159,160] Orofacial sensorimotor deficits are reported to be present in people with PD, [161] laryngeal somatosensory deficits have been identified, [162] and perception of speech has been reported to be affected. [50,88,163-166]

Importantly, people with PD have demonstrated deficits in accurately judging the loudness of their own speech, and that of their communication partners. [50,165,166] Compared with controls, people with PD perceived their speech to be louder both whilst speaking and when listening to their speech replayed, despite SPL being lower. [165] When people with PD were asked to produce a loud voice, it was typical for the voice to approach normal conversational levels, yet be perceived by the person with PD to be unacceptably loud. [167] When exposed to background noise, control participants increased their speech volume more than PD participants. [166] Conversely, when exposed to instantaneous auditory feedback, control participants lowered their speech volume more than PD participants. [166] Similarly, people with PD increased the volume of their speech with increasing distance from a conversational partner, but remained softer than controls at all distances, and overestimated their communication partner's loudness. [50] People with PD demonstrated an "over-constancy" in speech volume, with deficits in self-monitoring their speech volume and adapting to environmental factors. [50,166] It has been hypothesised that basal ganglia dysfunction results in abnormal sensory gating or filtering, leading to poor integration of sensory input. [161] Emerging PET evidence has demonstrated that people with PD have greater activation of the auditory cortex during speech than controls, which supports this hypothesis. [138]

Treatment of the communication disorder in PD must then consider sensory impairments. These difficulties are likely to affect the person with PD when monitoring their speech, and are explanatory factors for the clinical phenomenon of people with PD failing to recognise their dysarthria and to accommodate for speech and voice changes. [167,168]

1.1.6.3 Cognitive load. Communicating outside the clinic room presents a number of additional challenges for people with PD, including the need to communicate while performing other motor or cognitive tasks. Conversation itself in the naturalistic setting is

cognitively demanding, requiring speakers to attend to multiple communication partners, retain the information relayed, plan a response, monitor the conversation for appropriate places to take a turn, and to focus their attention despite the presence of external and internal distractors for example, background noise or the participant's own thoughts and associations; [114] The impact of competing demands on the speech performance of individuals with PD has received limited attention in the literature, despite conversation and speech tasks frequently being used as distractor tasks when assessing the impact of dual tasking on motor performance. [169]

The basal ganglia have been associated with automaticity of movement, and it has been suggested that they support an executive link between input and output, as well as providing connectivity between motor areas associated with automatic movement such as the cerebellum, supplementary motor area, premotor areas, and cingulate, dorsolateral prefrontal and parietal cortices. [170] The damage to the basal ganglia caused by PD theoretically makes tasks such as walking and speech less automatic, requiring people with PD to employ greater cortical control than do their healthy peers. According to a capacity-sharing model, this additional control may expend attentional resources, [170-172] negatively affecting the person with PD's ability to perform tasks when cognitive distractors are present or a motoric dual task is required.

Ho, Iansek and Bradshaw [169] used a dual task paradigm to investigate the role of attention in speech control in PD. Fifteen participants with PD and 15 healthy age- and sex-matched controls completed a tracking task (using a joystick) as a sole task, and whilst engaging in conversation and "loud" counting tasks. PD participants demonstrated an overall decrease in volume and a significantly higher rate of volume decay when the additional task was added, despite the performance on the motor task remaining comparable with controls. Conversational speech rate was reduced for PD participants in the dual-task condition, but was unchanged for controls. The PD participants demonstrated latency prior to commencing speech tasks in the dual conditions, and had a reduced duration of counting in the dual task. PD participants were also noted to pause more frequently, especially in the conversation condition. The authors suggested the PD participants were alternating their attention in a serial fashion, reaching the target area with the joystick before commencing speech, and pausing when off-target.

Similarly, a purely motoric simultaneous task has been demonstrated to reduce intelligibility for people with PD. Bunton and Keintz [173] compared the performance of four people with PD with four healthy age-matched controls during monologue production, single-word and sentence reading in single and dual task conditions, and during a covertly

recorded spontaneous speech sample. The healthy control participants' intelligibility did not differ between the single- and dual-task conditions, whereas the PD participants exhibited lower ratings of intelligibility for the reading and monologue production tasks in the dual-task condition. Intelligibility, mean fundamental frequency variation, mean SPL and rate were most similar between the spontaneous speech and dual-task monologue condition, with SPL and frequency variation being lower than in other conditions and rate being higher. No difference was detected across tasks for the language variables, although the nature of the dual task (motoric rather than cognitive) may not have led to sufficient competition with the resources required for language production, [173] and the measures taken may not have been sensitive to differences in language production, especially given the small sample size.

The negative effect of a distractor task on speech in PD, especially the disadvantage to automatic, non-visually controlled tasks, has considerable clinical implications. PD participants have been reported to exhibit better speech in the clinic room than at home. [118,174] The scrutiny of the clinician in the clinic may encourage people with PD to allocate more resources to their speech. In the home and community environment, the absence of this scrutiny and the presence of competing demands on attention (such as motor tasks or cognitive distractors) may result in resources being allocated away from speech production, resulting in decreased intelligibility. [169]

These studies pose a number of questions about the effect of a concurrent task on speech production in PD. Does the clinic setting encourage preferential allocation of cognitive resources to speech? What is the effect of activities of daily living on conversation when performed concurrently in the naturalistic setting? Does the additional cognitive load associated with conversation and turn-taking affect speech? The effects of dual-tasking in the community setting are yet to be explored in PD. Given the concerns raised in the literature about treatment effects failing to carryover outside the clinic room, [145] there is a need for further investigation of the speech performance of people with PD in the community setting, both prior to and following treatment. Such research needs to determine the effects of competing attentional demands on communication in PD, in both the laboratory and community settings. With regards to intervention, therapy for people with PD needs to extend beyond the conversational dyad typically employed, replicating instead the full range of cognitive challenges presented by communicating in the naturalistic environment.

1.1.6.4 Conversational behaviour in PD. Communication is far more demanding and complicated than phonating and articulating. Everyday communication – "talk" –

involves an intersecting and interacting set of practices including getting, taking, keeping and relinquishing a turn and repairing the conversation when something goes amiss. [175] This in turn is influenced by non-verbal abilities, such as the ability to maintain and keep appropriate eye contact, posture, and gesture, and the maintenance of personal space.

1.1.6.4.1 Pragmatic assessment. People with PD have been shown to have impaired pragmatic ability. [176-178] In a study by McNamara and Durso [177] 22 people with PD were compared with 10 healthy control participants for pragmatic function, as rated during a 10-15 minute conversation with an examiner. Participants with PD scored more poorly on items relating to conversational initiation, pause time between phrases, quantity/conciseness, feedback to speaker, speech intelligibility, and gestures and facial expressions, despite having comparable outcomes on measures of general cognition and verbal fluency with controls. These pragmatic impairments correlated with measures of frontal lobe function. [177] While motor deficits would certainly be expected to influence performance in the pragmatic abilities measured, the authors suggested that the relationship between pragmatic and frontal lobe function may relate to specific pragmatic deficits. Hall et al. [176] recruited 17 people with PD and 17 convenience control participants to participate in a study of pragmatic function in a clinical interview. Video-taped interviews of people with PD were scored lower on a pragmatic rating scale than that of the control group. [176] The scores of the participants with PD significantly correlated their duration of disease, and with their scores on the Unified Parkinson's Disease Rating Scale (UPDRS), [179] and the Mini-Mental State Exam (MMSE), [180] suggesting that pragmatic impairments increase with the severity and duration of disease and also with the progression of cognitive deficits. [176]

Pragmatic deficits in PD also correlate with measures of cognitive processing speed and working memory. [178] During a study by McKinlay et al, [178] 40 people with PD demonstrated poorer performance on the Test of Language Competence [181] compared with controls, and processing speed and working memory were predictive for language performance. [178] Participants with PD also appeared to lack awareness of these changes in pragmatic abilities. [177] Eleven participants with PD from a study by McNamara and Durso [177] assessed their pragmatic abilities using a self-rating scale, and nominated a familiar communication partner to complete the same scale. The PD participants consistently rated themselves higher than did their familiar communication partner. [177] Further research is required to further define the nature of pragmatic changes in PD, and in particular, to determine the interaction between the dysarthria associated with PD and

pragmatic function. How changes in pragmatic function impact on the daily lives of people with PD remains unclear, and could inform future intervention strategies. [177]

1.1.6.4.2 Exploration of conversation. Conversation Analysis (CA) is an established and rigorous approach to investigating the fundamental competencies of everyday communication that underpin social interaction. A detailed transcription of a recorded conversation is completed, including features such as pauses, intonation, laughter and sighing, and periods of overlap. Analysts then review the transcripts, seeking recurring patterns, and describe processes that the participants use to come to understand and make themselves understood, and by which the interaction is organised. [175,182] A significant body of work surrounding communication interaction in the healthy population exists, with features such as topic-setting, turn-taking, the development and conveyance of understanding, typical preferences, and processes of repair described. [175] The impact of dysarthria on communication in PD may potentially be described with CA, and recent work in PD has revealed patterns of communication that differ from the "norm". [182]

A recent study investigated the nature of overlapping talk and subsequent repair in conversations between people with PD and a familiar communication partner. Griffiths and colleagues [182] have described the conversation analysis of 10.58 hours of video footage of 13 people with PD and their primary communication partners. Data from eight of the 13 participants were associated with the two main themes about overlap to emerge from the analysis: the dysarthria of the participants with PD led to overlap situations, which necessitated repair, and instances of overlap occurred that could have lead to repair but did not. In talk between people without speech disorders, overlap often occurs after a pause proceeding from a turn where the next speaker was not selected. This was also observed for people with PD in this study, and the pattern emerged that this often led to a repair. The authors suggested that this pattern may be more common for people with PD, due to pauses and inappropriate silences being a feature of dysarthria in PD. Examples were also provided of PD participants overlapping midway through their communication partner's turn, which could potentially be attributed to delayed speech initiation or reduced cognitive processing. Overlapping speech also reduced the person with PD's ability to be heard, with examples of communication partners not recognising the need to repair, and data being unintelligible to the transcriber. There was also a greater tendency for the overlapped turns of participants with PD to be deleted than there was for their communication partners (in the corpus, 37 PD participants' turns were deleted compared with 3 of the communication partners'). Clinically, reviewing video footage of clients with

PD conversing with their primary communication partners may give information about how overlap unfolds in that dyad, [182] and may lead to targets for intervention.

Whitworth, Lesser and McKeith [183] investigated the interaction between people with cognitive impairment associated with PD and their primary communication partners. Twelve people with PD were recruited, six of whom had dementia with Lewy bodies and six with subcortical cognitive impairment. The method of analysis was a structured interview with the primary conversation partner and an analysis of conversation adapted from CA – The Conversation Analysis Profile for People with Cognitive Aphasia CAPPCA; [184]. Unlike CA investigations, the primary data for this study was quantitative, and taken from the interview. Qualitative data from the analysis of the conversation sample served to provide evidence for the findings of the interview, and illustrate the influence of carer strategies. The carers reported that the participants with PD experienced difficulties in initiation of speech, topic management, repair, memory and attention, word finding, prosody, and daily fluctuation. Some carers of people with subcortical dementia reported that the PD participants violated the communication partner's turn. Carers of people with Lewy body dementia reported that hallucinatory topics, repetition of favourite topics, comprehension problems, the ability to stress words, and fluctuating ability week by week were problematic. The most common strategies used by carers to address problems in conversation were facilitatory in nature. Other reported and observed strategies included confrontation, acceptance of the problem communication behaviour, avoidance of conversation, ignoring problem utterances, and emotional responses. The authors reported that these strategies influenced the conversation behaviour of the PD participants. For example, use of avoidance strategies by communication partners, such as rhetorical questions and speaking in monologues, limited the PD participants' opportunity to speak. The wide variability between the participants and people with PD in general limited the ability to generalise group data. [183] However, the qualitative data provided ample evidence of conversational difficulties that extend beyond speech impairment for people with PD and concomitant cognitive impairment. The wide variety of spontaneous strategies employed by communication partners was also highlighted.

The emerging evidence suggests that everyday communication in PD is affected by dysarthria and that the effect may be compounded by both concomitant cognitive-linguistic deficits and environmental factors. Consequently, assessing and targeting interaction and communication in the community setting is particularly important for the management of people with PD. Despite the importance of holistically addressing the impact of dysarthria

in PD, speech-language pathologists working in community settings report that there are insufficient tools to assess and treat interaction. [185]

The provision of effective treatment for the communication disorder in PD that addresses the full impact of the communication disorder on the everyday life of the person is of paramount importance to clinicians. While considerable research has been done to address the perceptual and physiological impairments associated with dysarthria in PD, there is a need to address the communicative challenges in everyday conversation for the person with PD and to provide long-term maintenance strategies.

1.1.7 Study Aims, Hypotheses, and Research Plan

While group therapy shows promise as an intervention, the methods employed have been diverse, and do not explicitly target known areas of difficulty associated with PD. Therefore, the aims of this research were:

1. To explore the feasibility of group therapy in improving the speech of people who have previously completed intensive individual treatment (LSVT LOUD®).
2. To examine the interactions in conversations involving people with PD, before and after group therapy.

It was hypothesised that following the intervention, people with PD would demonstrate improvement on acoustic and perceptual measures of speech, and measures of quality of life and communicative effectiveness. Additionally, it was hypothesised that dysarthria severity would be an influencing factor in the participants' response to the intervention. Qualitative methods were included to describe conversational behaviours before and after group therapy. It was intended that the results of this pilot study would inform the future development of the group program in preparation for future controlled research studies.

1.1.8 Thesis Outline

This thesis describes the development of a group therapy intervention for the maintenance of speech and conversational abilities in PD, and reports initial outcome results. All studies were submitted for ethical clearance, and received approval from the University of Queensland's Medical Research Ethics Committee (see Appendix A).

Chapter 1 presents the background to the current study, and rationale for the proposed research.

Chapter 2 describes the rationale for the development of a group therapy program (Loud and Proud) and the theoretical bases underpinning the targets for behavioural

change, activities, resources, and dosage. A detailed description of the program is provided.

Chapter 3 describes the pilot study, which investigated the impact of Loud and Proud on the perceptual and acoustic features of speech, communicative effectiveness, and quality of life in 12 participants with PD pre- and post-intervention.

Chapter 4 reports on the conversational analysis of speech samples of six people with PD before and after Loud and Proud. Conversational behaviour before and after group intervention is described, as well as the impact of varying levels of severity of dysarthria on conversation.

Chapter 5 is a summary of the findings, clinical implications, directions for future research, and the conclusions reached from the research included in this thesis.

2. The Background, Design and Rationale for Loud and Proud

Interaction in the everyday environment is impacted by the speech and cognitive-linguistic changes that accompany PD. [30,31,156] Reduction in the intelligibility of speech combined with pragmatic deficits, cognitive changes and associated cognitive-linguistic disorders negatively impacts confidence, relationships, social engagement and wellbeing. [31,156,186] Intervention, therefore, needs to address the communication disorder throughout the course of the disease. In doing so, intervention must target the communication competencies relevant to everyday life. This chapter describes the rationale and development of a group therapy program, Loud and Proud, designed to follow on from the LSVT LOUD®, to enhance and maintain communication in PD.

2.1.1 Factors underpinning communication disorder in PD.

The communication disorder in PD is multifaceted, with interacting motor, sensory, cognitive and linguistic components. As discussed in Chapter 1, these individual areas have been explored in clinical studies, although their impact on conversation has only recently been investigated. [182]

2.1.1.1 Speech disorder. The features of the hypokinetic dysarthria associated with PD are well-documented, and typically include reduced loudness, hypoprosody, hesitation, harshness, huskiness or breathiness, and imprecise articulation. [24,34] Unlike other motor symptoms, dysarthria in PD is largely resistant to levodopa therapy [24] and unsurprisingly worsens over time due to the progressive nature of PD. [187] This presents challenges for the person with PD and their health care professionals across the course of their lifetime.

2.1.1.1.1 Downscaling of movement. The underlying speech movements of a person with PD often appear to be preserved, but with reduced range, amplitude, flexibility and speed. [21] Traditionally, these deficits have been attributed to two of the cardinal symptoms associated with PD – rigidity and hypokinesia [34] – but recent research has suggested that the underlying physiological deficits are more complex. [140]

Hypokinesia is certainly a factor in hypokinetic dysarthria, and people with PD present with a reduced range of articulatory movement, that progressively deteriorates while speaking. [41,61,140,188,189] Thus, the person with PD may demonstrate soft vocal volume, reduced prosody, and imprecise articulation that tend to worsen during the

conversation. However, people with PD have the physical capacity to improve their hypophonia with external cues to speak loudly. [166]

2.1.1.1.2 Sensory impairment. There is evidence that sensory and perceptual deficits also underlie the hypokinetic dysarthria in PD. Specifically, sensorimotor deficits are reported to be present in the speech motor systems [161,162] and people with PD have demonstrated deficits in the perception of speech. [30,31,88,156,164-166] Both sensory and motor aspects of the speech disorder in PD need to be addressed in therapy, consistent with the hypothesis that associates reduced amplitude of movement in PD with both abnormal neural drive to the speech mechanism and abnormal sensorimotor gating. [167]

2.1.2 Cognitive dysfunction.

The ability to bring to the foreground, maintain, and manipulate important information, known as executive function, [190] is disrupted in PD. Dysfunction of the dorsolateral prefrontal cortex is implicated in the cognitive changes that occur in PD. [13,15,191]. These changes can occur even in early stage PD. [191,192] Both automatic and controlled cognitive processing is slowed, [191] and impairments in sub-components of the executive functions such as working memory, set shifting, problem solving, planning, and verbal fluency are consistently reported. [191,193-196] PET and fMRI imaging have revealed that these deficits are related to decreased activation in the caudate nucleus, suggesting that deterioration of dopaminergic cells disrupts the neural networks linking the striatum and the pre-frontal cortex. [191,196] The frontostriatal circuits involving the anterior cingulate cortex and orbitofrontal cortex are also involved in cognitive disturbance in PD to a lesser extent, and are implicated in the behavioural and emotional disturbances that occur in this condition. [13,15]

Working memory is the ability to temporarily store and manipulate information. [197] Working memory underpins the ability to think [197] and is essential for participating in the activities of daily living. [198] The working memory deficits that are present in people with PD may underlie much of the cognitive disturbance in PD, [199] including cognitive-linguistic deficits. [85,93,99,200]

Cognitive rehabilitation has been shown to be beneficial for people with PD, although the studies lack follow-up data and the sample sizes are small. [115] Behavioural intervention for cognition may be either restorative or compensatory. [115] Restorative techniques aim to improve cognitive functioning, while compensatory techniques provide strategies to improve performance and improve self-management. [115] Recent data suggests that working memory may be improved with practice in optimally medicated

people with PD, but not in those with dementia. [198,201-204] Specific cognitive rehabilitation was shown to improve performance where placebo speech therapy intervention (drawing the person with PD's attention to his/her communication and speech deficits) had no effect. [204] These findings suggest that training must be specific to deliver improved executive function. [205] Cognitive rehabilitation was feasible and well-received by people with PD, who reported progress, [115,206] and found even challenging activities rewarding. [206] Larger scale studies are required to investigate the effects of cognitive rehabilitation, including effects on performance in everyday activities of life and long-term maintenance of effect. [115,204]

2.1.3 Cognitive-linguistic disorder, speech, and conversation interactions.

The cognitive-linguistic disorder associated with PD has been extensively described in Chapter 1, including the presence of syntax processing deficits, the ability to decode non-literal meaning (emotion processing, metaphor and inference), and the effects on high level verbal explanation.

Given the findings in cognitive studies, and the interaction amongst cognition, linguistic ability and motor-speech function, [13,169,173] it seems reasonable to hypothesise that cognitive-linguistic difficulties may prove problematic in conversation, [182] especially in circumstances with cognitive load. People with PD have reported experiencing difficulties getting into, and keeping a place in conversation. [31] Conversation itself presents a number of cognitive challenges for speakers [114]: simultaneously attending to multiple communication partners, following what has been said and what is currently being said, [31] and determining what to say next while monitoring where to enter a conversation. [74,207] Conversation analysis (CA) has revealed a tendency for people with PD to overlap with their communication partners, especially after a pause. [182] The speech of people with PD has been reported to have more pauses and hesitations. [57,157,182] Difficulties initiating speech and slowed cognitive processing may have caused participants with PD to miss their turn, and then subsequently overlap their communication partner. [182] Overlap was reported to result in the PD speaker experiencing difficulties in being heard. [182] These difficulties were compounded by articulation and voice deficits. [182] The subsequent repair was noted to be problematic at times, and speakers with PD were reported to be prone to deletion of their turn. [182] Notably, Griffiths et al. [182] reported that difficulties with overlap occurred in speakers ranging from intelligible to severely dysarthric. [182] Therefore, assessment of intelligibility in isolation may not reflect the impact of PD on a person's conversational ability. [114]

2.1.4 Pragmatics.

People with PD present with pragmatic deficits, that is, the interruption of verbal and non-verbal social-communication skills. [176] With the presence of sensory, cognitive, speech and motor deficits in PD, it is not surprising that intonation, facial expression, eye contact and gesture are often impaired compared to the healthy aged. [176] Similarly, motor, cognitive and linguistic deficits are likely to influence conversation initiation, turn taking and response duration for people with PD when compared with the healthy aged. [176-178]

2.1.5 Capacity versus performance.

The World Health Organization's International Classification of Functioning, Disability and Health (ICF) [17] makes a distinction between a person's ability to function in a standard environment (capacity) and ability to function in his/her own environment (performance). [20,208] The clinic room is a pristine communication environment. Conversation takes place in a sound-attenuated room, with a speaker who has expertise in listening to the speech of people with communication disorders. Assessments in general are standardised, and don't include confounding influences such as interruptions, distractions, background noise, and heightened emotion. The person with PD knows his or her speech is being assessed, and can concentrate on speaking clearly. [173] As such, performance in the clinic setting is only partly reflective of communicative performance; environmental factors must be considered in the assessment and management of people with PD.

2.1.5.1 Cognitive competition. The addition of a cognitively demanding task has been shown to negatively affect speech, resulting in lower speech volume, increased volume decay, and increased pause time. [169] It has been hypothesised that the person with PD allocates attention to their speech in a laboratory or clinic room setting. [173] Treatment should include cognitive challenge in order to better replicate the naturalistic environment and enhance transfer of skills beyond the clinic door.

2.1.5.1.1 The complex nature of conversation. Conversation is a deeper act than the production (and reception) of words in orderly sequence. "Talk" is the primary way we engage with one another; it is how we argue, beg, entice, compliment, insult, persuade, rationalise, and socialise [209]. Oral conversation is our primary method of interaction [209]. While it has been argued that dialogue is easier than monologue [210] – and intuitively that seems to be the case – conversation holds a particular set of complexities likely to unsettle the person with PD. A primary challenge is distraction. In normal speakers, the more complex a conversation, the more challenging it is to perform tasks such as monitoring for

traffic and obstacles. [211] For people with PD, this level of distraction has the potential to reduce the ability to use strategies to improve speech intelligibility. As communication is achieved via collaboration between speakers, analysis of the conversational interactions between people with PD and their communication partners is warranted.

2.1.5.1.2 Environmental noise. Background noise is an unavoidable part of everyday life; traffic, background music in shops, and speakers at the next table all present competition to the signal that the person with PD is sending to the listener. Background noise reduces a listener's ability to understand speech, including the speech of those without a communication disability. [158] People with PD, however, have demonstrated a reduced ability to increase loudness to compensate for background noise. [166,212,213] Background noise also has also been reported to have a greater detrimental effect on PD speakers' intelligibility than it does for their healthy peers. [158] The strategy of social withdrawal that some people with PD have reported to use in response to their communication deficit [31] may in part be explained by this reduced intelligibility when background noise is present.

2.1.6 The perspective of people with PD.

Recent studies have described the experiences of people with PD and dysarthria when communicating outside of the clinic room setting. [30,31,156] People with PD have reported they find it difficult to get their message across and have lost confidence. [30] For some, failure to be understood within the family led to arguments about whether the problem was the dysarthria or the listener's failure to attend. [31] Understandably, this in turn was reported to lead to frustration, feelings of inadequacy, tension, depression, withdrawal, resignation and a sense of loss of independence. [30,31] Importantly, negative changes occurred over time, and people with PD reported an increasing concern about their communicative competence, confidence, and ability to get their message across. [156] People with PD expressed more concern about the effects of the communication impairment on self-concept, participation, and family dynamics than the actual speech and language change. [31]

As previously discussed, a range of factors impact on the communication of people with PD. The progressive nature of the speech, cognitive-linguistic, and pragmatic disorders [187] and the influence of external factors on communication in PD [158,169] requires a comprehensive approach to intervention. [152] Management plans for people with PD should address speech, cognitive-linguistic and pragmatic impairments, focus on everyday

communication, incorporate regular maintenance strategies and facilitate self-management.

2.2 Current speech treatment

Behavioural intervention is currently the treatment approach with the strongest evidence for the remediation of dysarthria in PD. [10,44,112,123,124] Across the past two decades, the Lee Silverman Voice Treatment® (LSVT LOUD®) has been the subject of randomised control trials, with the results demonstrating that the treatment is effective in improving speech in PD, with effects lasting up to two years. [125-127,214] As such, the use of continued behavioural intervention in maintaining communication in PD following the LSVT LOUD® is worthy of future research.

2.2.1 Neuroplasticity, the LSVT LOUD®, and Maintenance.

The underlying principles of the LSVT LOUD® are consistent with those of neural plasticity. [140] The principles of neuroplasticity provide guidance for the structure and content of intervention that is likely to facilitate changes in brain function and improved outcomes following treatment. [215]

2.2.1.1 Early and continuous practice. Recent research into the neurobiological change associated with exercise in PD has provided evidence for recommending early and continuous behavioural intervention in PD. [167] The LSVT LOUD® provides a model for intensive early intervention, and the focus on everyday speech means that practice is ongoing in the everyday life of the person with PD. However, due to the progressive nature of the impairment, it becomes evident clinically that sound pressure level (SPL) and the effort invested by people with PD in maintaining functional conversation reduces over time. Predictably, patients have reported that their home practice also becomes less consistent over time. Research is indicated to investigate methods that recalibrate the vocal loudness of the person with PD and increase effort and exercise in the longer-term.

2.2.1.2 Intensity and quantity of practice. The LSVT LOUD® is a high-effort, intensive intervention – 16 hours over four weeks plus homework tasks – with multiple repetitions of tasks each day, and increasing expectations of effort, consistency and accuracy over the course of the treatment. [129,167] With intensity, activation of the corticostriatal terminals is increased leading to synaptic plasticity in the striatum. [167] In PD, however, sensory deficits, force control fatigue, depression and degeneration of cardiac sympathetic innervations have been reported to obstruct high effort training. [167] Given the importance of continued practice in effecting long-term structural change in neural

functioning, [129] a formalised maintenance schedule is a logical next step. Maintenance therapy provides the opportunity to revisit speech exercises previously taught, and to reset expectations of effort, consistency and accuracy with the aim of achieving and enhancing neural plasticity.

2.2.1.3 Use it and improve it/Use it or lose it. Facilitating the person with PD to recognise the need for ongoing exercise to manage their condition can be a challenge. [167] Following behavioural intervention, there may be a minimum amount of use required to maintain the effects of speech therapy. [167] The LSVT LOUD® targets the everyday speech of people with PD; subsequently, everyday communication becomes continuous practice. [129] With the progression of the disease, remaining dopaminergic neurons are susceptible to inactivity. Decreased activity may accelerate the progression of deficits in PD. [167] Maintenance intervention, therefore, may provide a method to increase the motivation for, and frequency of use of, high-effort speech.

2.2.1.4 Saliency. The LSVT LOUD® incorporates familiar and functional activities into each treatment session. Carryover tasks in the everyday life of participants lead to positive and encouraging feedback from listeners. [129,168] Learning is enhanced when tasks are emotionally rewarding, [129] due to the activation of basal ganglia circuitry and phasic modulation of dopamine levels required for striatal plasticity and learning in PD. [167] Due to cognitive changes, such as depression and loss of motivation, and a lack of awareness of deficits, people with PD may not (without extensive reinforcement) recognise the benefits gained from therapy. [167] Maintenance therapy then should provide opportunities to practise familiar tasks that are clearly related to the clients' goals, with repeated and rewarding positive feedback.

2.2.1.5 Complexity. In PD, dual task deficits negatively affect the ability to complete complex tasks. The LSVT LOUD® addresses this issue by training complex movements, with a single target for the participant to focus on (increasing vocal amplitude). [120,129] The complexity of tasks is gradually increased over the course of the program, adding cognitive load, dual tasks, and increased duration and difficulty of the speech task. [120] Complexity is an important element in intervention, as plasticity is enhanced with the training of complex movements and environmental enrichment. [167] Maintenance therapy provides an opportunity to extend the complexity of tasks undertaken in individual therapy.

2.2.1.6 Timing matters. The LSVT LOUD® can be employed early in the progression of PD, to avoid underactivity that may occur due to deficits in monitoring the motor performance in speech. As early exercise has been theorised to promote plasticity

and perhaps slow progression of PD, [167] early intervention would seem appropriate. To maintain these benefits, ongoing management of communication is required for the patient's life-span with the disease. Failure to provide maintenance intervention presents a risk that deterioration in performance and accuracy will occur, as well as a reduction in practice over time with subsequent underactivity.

2.2.2 Building upon the LSVT LOUD® foundations.

As already discussed, the LSVT LOUD® is highly effective at recalibrating participants' levels of vocal loudness and effort. However, its treatment format is largely clinic based and does not allow for the clinician to observe and provide feedback to the person with PD in a more natural conversational setting. [152] Maintenance intervention has the potential to incorporate methods which provide more naturalistic practice environments. The cognitive-linguistic deficits associated with PD could also be addressed in a maintenance program. [13,114,182] Participation in conversation may also be affected by the person with PD's self-perception of communication ability. [30,31,114] The intensive nature of LSVT LOUD® in targeting the impairment level of the dysarthria precludes more general counselling or problem solving about communication. Intervention to support self-management and facilitate participation needs to be considered after the individual impairment-based therapy has been completed. [152] Additionally, it has been hypothesised that social interaction, cognitive stimulation and physical activity may slow the progression of cognitive decline and dementia. [216] Maintenance intervention, then, should be focussed at the conversational level with cognitive challenge, incorporating methods that facilitate participation.

2.2.2.1 Self-efficacy. PD is a chronic condition which requires the person with PD to self-manage his/her symptoms from day to day. [217,218] People with PD need a suite of skills to manage the impact of their speech and cognitive-linguistic disorders on communication and need to be confident in their ability to employ these skills.

Self-efficacy is a concept that is specific to a task, and relates to an individual's, or group's, belief that he/she/they have the power to produce a desired effect. It has been hypothesised that this influences cognitive, motivational, affective and decisional processes. [219,220] People with the same level of skill can perform differently on tasks based on their application of skills in the naturalistic environment. [221] Similarly, an individual's performance can vary over time depending on their confidence in their ability to apply the skill. [219] Predictably, people who expect to be able to perform well on a task outperform those with less confidence in their ability. [219,221] Resilience relies on this expectation of

success, as without the belief that achieving a desired action is possible, there is little incentive to persevere when faced with obstacles. [219] It is insufficient to simply possess skills; one must know he/she is effective in their application. [217]

In chronic disease management, self-efficacy has been reported to be influential in the success of self-management. [218,222,223] Fortunately, self-efficacy can be positively influenced with intervention, and should therefore be promoted in the management of chronic disease. [223-225] Self-efficacy is built when a person experiences success in using a skill, witnesses others successfully using a skill, or receives verbal persuasion and encouragement. [221,226] A maintenance program for communication in PD is therefore integral to the holistic management plans of people with PD.

2.2.3 Group Therapy for Communication in PD

Group therapy has the potential to provide two important aspects of a speech and communication maintenance program. Firstly, this mode of service delivery provides an opportunity for ongoing practice after the LSVT LOUD®, to enhance and maintain its effects according to the principles of neuroplasticity. [227] Secondly, the nature of group therapy provides an opportunity to extend the targets of the primary intervention [152] by increasing the complexity of tasks, and to address the cognitive-linguistic complexities of conversation [13,182] and the negative effect of distraction [158,169,173,212,228] on the communicative interaction. Specifically, group therapy affords participants the opportunity:

- to practise cognitive-linguistic skills required for communication, in particular, working memory
- to practise the skills required to engage in conversation, in the presence of cognitive load
- to engage and participate in salient conversational interactions
- to recalibrate effort and loudness in the presence of background noise, multiparty conversation, and in activities with cognitive load
- to experience communication success, and peer support and encouragement, to improve self-perceptions of communication
- to take responsibility for monitoring communication ability, and to develop a management plan
- to re-establish home practice routines
- to refresh the clinical effects of the LSVT LOUD® on motor and sensory aspects of speech.

Initial studies involving group therapy for dysarthria in PD have suggested its use as a maintenance strategy is feasible, especially following intensive individual therapy to optimise the voice and teach responsiveness to the internal cue, "loud" [152]. As described in Chapter 1, small scale studies have suggested that group therapy can improve intelligibility, SPL, and self-rated perception of self-ratings of communicative effectiveness. [23,145,149,229] The gains achieved in group therapy, however, may not be as great as those achieved with intensive individual therapy [23] and follow-up data is limited. Group therapy may improve both the speech and conversational interaction of people with PD who have previously completed individual intervention. [152]

2.2.3.1 Targets for behavioural change. The target behaviours for improving speech intelligibility in people with PD have been simplified across the history of group therapy, consistent with developments in motor learning theory. [130] Early studies by Robertson and Thompson [229] and Sullivan, Brune and Beukelman [145] had multiple targets, including respiration, phonation, articulation, and prosody. Later, the influence of the work of Ramig and colleagues [120,134,230] and the proven efficacy of the LSVT LOUD® led to a simplified focus on loudness and effort. [23,149,152] De Angelis and colleagues [149] targeted increased phonatory function through high-effort exercise, and cued for maximal articulatory movement, or "overarticulation". Searl et al. [23], and Manor and colleagues, [152] targeted increased loudness and effort as the primary speech behavioural change in their groups.

In addition to speech behaviours, conversation behaviours were also targeted by Manor and colleagues. [152] Their group therapy design included informal conversation practice as well as supportive counselling to encourage problem solving for difficult communication situations, and to define the roles of the person with PD and their family members in conversation. Their finding of improved pragmatics and initiation in conversation for their group members has given a promising indication of the usefulness of group therapy for speech and communication maintenance in PD.

2.2.3.2 Dose and timing. There has been significant variability in dose reported across the studies of group therapy. The therapy doses utilised to date have been summarised in Table 1.

Table 1: Summary of Intervention Doses for Group Speech Therapy in PD

Study	Length of sessions	Sessions per week	Weeks	Total number of sessions	Total dose in minutes
Searl et al. [23]	90 minutes	1	8 weeks	8	720
Manor et al. [152]	75 minutes	1	8 weeks	8	600
de Angelis et al. [149]	45 minutes	3	4 weeks	13	585
Robertson and Thomson [229]	3.5 – 4 hours	5	2 weeks	10	>2000
Sullivan et al. [145]	Not reported	2	4 weeks	8	Not reported

The length of treatment block and frequency of intervention needs to be determined according to the treatment goals, but should also consider physical and financial limitations experienced by clinical services and people with PD. [23,145,149,152] While de Angelis, Mourao [149] sought to maximise intensity of intervention, they reported that a daily therapy program was impracticable due to the physical and financial constraints on transport experienced by people with PD. Robertson and Thompson [229] used taxi travel to overcome this barrier, but noted it was an expensive solution. Clinical feasibility and participant availability [149] are important factors in deciding dose, and must be weighed against the benefits of intensity. Alternative methods of enhancing intensity, such as home practice, [23] may improve the clinical feasibility and outcomes of group therapy.

2.2.3.3 Home program. The use of a home program can increase the dose of intervention, and the majority of group programs reviewed utilised home practice. [23,145,149] Searl and colleagues [23] included a compulsory home program and required participants to complete a daily practice log. The home program comprised the core activities (sustained vowels, pitch glides, and "social phrases") and activities that paralleled the group work (e.g. reading). The exercises required 30-45 minutes each non-group day, across two sessions, and 20-30 minutes on group days. De Angelis et al. [149] reported that their participants practised prescribed exercises at home, although the dose was not described. Sullivan, Brune and Beukelman [145] provided participants with a video of the group performing activities to guide participants' home practice. Manor et al. [152] prescribed home practice each week, targeting increased phonatory effort in speech tasks and practising strategies in nominated communication opportunities at home, such as conversing with a bank teller, or participating in a family conversation. Home practice is an important feature

of group therapy, increasing dose [23] and providing opportunities to promote generalisation to the home environment. [152]

2.2.3.4 Feedback. Feedback schedules varied across studies, with biofeedback, clinician feedback, peer feedback, and external cues variously applied. The clinicians conducting group programs provided feedback based upon their perceptual assessment of the participants' speech and voice. [23,149] In particular, Searl et al. [23] followed the example of the LSVT LOUD® with their clinicians modelling a louder voice and verbally reinforcing effort and loudness. While a feedback schedule was not formalised, the authors reported that frequent verbal feedback was provided when the group or an individual was not responding at the target loudness. [23].Robertson and Thompson [229] provided biofeedback by video-taping participants and replaying the segments, encouraging the participants to critically appraise their own performance, and that of their peers. In contrast, Manor and colleagues [152] provided written cues for their participants throughout the sessions – "wide open mouth", "slow rate" and "loud voice" – citing the evidence for external cues in enhancing performance in PD. [163] The authors noted that these cues assisted the participants to internalise the strategies without interrupting the activities, although details about this process were not provided. [152]

In addition to clinician feedback, peer feedback may be beneficial. [23] Searl and colleagues [23] reported that breaking into dyads for conversation practice resulted in "relatively natural" feedback from peers. Robertson and Thomson [229] employed peer feedback as part of their program design, and actively encouraged participants to provide feedback to one another. Consideration must be given to the method and schedule of feedback in the design of group therapy, taking into consideration the targets of intervention.

2.2.3.5 Group size and number of facilitators. In general, most group intervention involved groups of five to seven participants. De Angelis et al. [149] treated participants in groups of five. Robertson and Thompson [229] set a target number of eight per group, and due to lower than expected recruitment, conducted a group of five and a group of seven participants. Sullivan, Brune and Beukelman [145] treated a group of six participants with PD, with some spouses also attending. In contrast, Searl and colleagues [23] delivered group therapy to 15 participants with PD. The clinicians who conducted the therapy noted they were able to assess performance most of the time, but that it was harder, particularly in choral work. In particular, they noted that individual response frequency was reduced in group activities, and so employed dyad and triad conversations in order to increase the speaking time for each participant. [23]

A number of studies into group therapy had multiple facilitators per group, varying across group size and methodology. The largest group predictably had the largest number of clinicians. Searl and colleagues [23] had one experienced speech-language pathologist and three graduate students facilitate their group of 15. Robertson and Thompson [229] completed their group programs together, allowing the one author to provide individual sessions for group members as required, while the other continued therapy for the remainder of the group. Manor and colleagues' [152] design required the involvement of a social worker in addition to a speech pathologist, to facilitate group counselling. De Angelis et al. [149] did not define the number of clinicians involved in each group treatment, although their group design lends itself to a single facilitator. De Angelis et al. made the observation that their aim was to design a research method practicable for any speech pathologist. Clinical utility and health economics demand that staffing levels be considered in future research into maintenance programs in PD.

2.2.3.6 Group activities. The tasks prescribed varied across studies. The most recent studies included tasks from the LSVT LOUD®, adapted to make them possible in a group format. [23,152] Elsewhere, the LSVT LOUD® principles of loudness, effort, and intensity were applied, but with significantly adapted exercises such as phonating with arm movement. [149]

Conversation practice was frequently included in the group studies. Conversation was undertaken informally, [145,152] as a group, [23,145,152] and in dyads and triads. [23] Searl and colleagues [23] set topics, such as travel, hobbies, and family stories. Manor and colleagues continued conversation practice during supportive group counselling about communication, led by a social worker. The topics for the counselling sessions were determined according to participant feedback, and strategies were typically provided by the group facilitators, with some input from PD participants. [152]

More formal group activities were also described, and included quizzes, speech-making, interviewing, [229] and role-play [152,229]. Some researchers included reading as an activity, and the materials included items such as poetry, classified advertisements, recipes, [23] and plays. [229]

The evolution of group therapy towards interventions based upon the principles of the LSVT LOUD® has provided researchers and clinicians with guidance regarding feasible activities for group work. The lack of detail concerning the activities in earlier studies, however, has resulted in replication of the research being difficult. [231]

2.2.3.7 Treatment space. Appropriate space for group therapy is an important consideration. [229] In previous studies, conference rooms were frequently used, and

needed to be sufficiently large for the group. [229] The setup was infrequently described, and ranged from desks set in a U-shape [23] to spaces with "easy chairs" [229]. The availability of a kitchen for tea and coffee making was noted to be beneficial. [229] There was no report of noise within the rooms being a problem in the group therapy. On the contrary, Searl et al. [23] reported the background noise and distraction in the room encouraged participants to attend to increasing their loudness, making these positive factors in the therapy.

2.2.3.8 Family involvement. The advantages and disadvantages of involving family in therapy have been reported previously. Benefits include providing support for a home program, opportunity for communication practise with a familiar partner, [143] and the opportunity to develop strategies specific to the family unit. Some PD participants from Sullivan et al.'s [145] study brought family members along for the entire program. Manor et al. [152] elected to have family members attend for one of their eight group sessions, to practice the core exercises with the person with PD and participate in a group discussion about the roles of family and people with PD in communication. Family members were included to provide a communication opportunity closer to that of the home environment, and to encourage family involvement in home practice. [152] Where practice intensity is required, however, the presence of family members in the session may reduce the speaking opportunities for the person with PD. In addition, people with PD have reported that listeners speak for them, talk over them, or don't wait for an answer. [31] Apprehension and withdrawal in social situations have been reported by people with PD. [31] The studies that restricted participants to people with PD may have avoided these potential negative influences.

2.2.4 Current Limitations to Group Therapy Programs for PD

Given the superiority of the LSVT LOUD® outcomes following individual therapy over group programs for speech in PD, [23] people with PD should be offered the LSVT LOUD® as their primary intervention. No study to date has investigated the effects of group therapy as an adjunct or follow-up intervention to the LSVT LOUD®. Previous studies explored group therapy as a primary or adjunct to primary intervention. The interventions mostly focussed on motor speech, intelligibility and compensatory strategies, as opposed to targeting higher level cognitive-linguistic function. Further research into the use of group therapy as a follow-up to intensive individual therapy, and with a focus on higher cognitive-linguistic function, is required.

While the viability of group therapy as an alternative to individual therapy has yet to be established, the emerging evidence suggests that group therapy is feasible and does

improve speech outcomes for people with PD. As such, group therapy may provide a cost-effective method for ongoing speech maintenance in PD following intensive individual treatment. Group therapy based upon the principles of the LSVT LOUD® may provide opportunities to refresh treatment effects, provide conversation practice in a setting that more closely approximates the challenges of social interaction, and may be especially beneficial considering the motivational and psychosocial benefits of group therapy. [23,149,151,152,232,233]

2.2.5 Development of Loud and Proud

To this end, a group therapy program, Loud and Proud, was developed utilising the foundations of the LSVT LOUD®. The program was an eight-week maintenance program. Loud and Proud was designed to re-calibrate the participants' loudness and effort in speech, and to promote generalisation of the therapeutic effects of the LSVT LOUD®. Participants were encouraged to be accountable for monitoring therapy involvement and outcomes, by reducing the reliance on instrumental measures in therapy, and by increasing the cognitive difficulty of the therapy tasks to better simulate the naturalistic environment. In providing the opportunity to practise speech and conversation under these conditions, with feedback from the clinician and peers, it was anticipated that self-efficacy would be heightened.

2.2.5.1 Target behavioural change.

***2.2.5.1.1 Loudness and effort*.** The feasibility of cueing for increased loudness and effort in a group setting has been demonstrated. [23,149,152] Increased loudness and effort were subsequently the primary cues provided to participants during the Loud and Proud group intervention, consistent with the foundations of the LSVT LOUD®.

2.2.5.1.2 Conversation behaviour. People with PD have reported that participating in conversation is difficult, [31,234] and the intersecting influences of motor speech and cognitive linguistic change can negatively affect conversation for people with PD. [182] Manor and colleagues [152] have demonstrated that a group program can influence turn-taking and initiation behaviour as assessed in the clinic room setting, providing preliminary evidence that conversation behaviour can be influenced by therapy. Conversational behaviour, then, was included as a target for Loud and Proud intervention, being a feasible goal as well as salient to people with PD.

2.2.5.1.3 Self-management. Provision of a chronic-disease self-management focus has been found to result in a better quality of care and improved outcomes for clients. [235] While not specifically a self-management program, Loud and Proud was designed to be

consistent with the participants' broader self-management strategies. The chronic-disease self-management framework calls for a move away from a model where the clinician holds the knowledge and power to make change. [218] Instead, chronic disease management requires an activated team, with the person with the chronic disease as the leader. [218] Consequently, the person with PD was made central to the design of Loud and Proud, in recognition that learning hinges on personal involvement, self-initiation, and at its best should be learner-evaluated and autonomous. [236] It was also recognised that the group provides a source of knowledge about communication strategies in PD. [152] A conducive and motivating environment, relevant and interesting resources, targeted and specific intervention, and evaluation and future planning have proven to be essential components of working with adults. [236] All of these aspects were considered during the development of the elements of Loud and Proud program.

2.2.5.2 Dose and timing. The timing of the intervention was considered in the context of a maintenance strategy. De Angelis and colleagues [149] offered a monthly maintenance program immediately following their primary intervention, which decreased in frequency over time. In contrast, the purpose of Loud and Proud was not to continue and consolidate a primary intervention, but instead to refresh the effects of the LSVT LOUD® and recalibrate the loudness and effort of people with PD after the effects of primary treatment may have begun to fade. As such, a time-limited block was selected, to allow participants to enter the group once they had noticed a deterioration in their communication, or at a time when clients had goals for participating in intervention (for example, maintenance of communication). It was anticipated that the time-limited block would also allow the group to form in a shorter period of time. [237] As Loud and Proud was structured as a maintenance intervention, participants did not commence the program until at least three months after completing the LSVT LOUD®.

In order to ensure a sufficient dose of intervention, Loud and Proud participants attended a 90-minute group session once per week over eight weeks, totalling 720 therapy minutes. This dosage was consistent with that provided by Searl and colleagues, [23] which resulted in increased SPL for that study's participants as assessed in monologue production. The potential to influence the routine of a home program was considered to be the additional advantage of an eight week program over a greater frequency across a shorter period. Routine and habit are inter-related, and establishing positive routines in the management of chronic disease can assist with more habitual use of strategies. [238] In the case of Loud and Proud, the ability to encourage home practice over eight weeks was considered advantageous towards setting a home practice routine and increasing the

automaticity of using a loud voice and effort. The week between sessions allows participants more opportunities for home practice. The opportunities to discuss and debrief in the group about progress and difficulties were also distributed over a two month period.

2.2.5.3 Home practice. The Loud and Proud dose was increased by implementing a home program. [23,149,152] The participants reported to the group about their home practice each week. In order to establish a sustainable routine, participants completed the LSVT LOUD® maintenance schedule daily. [128] Habit formation is enhanced by repetition of a behaviour [239] and as such, the prescribed daily practice schedule from the LSVT LOUD® was strongly recommended to participants, not only for the period of the intervention, but also as a long term maintenance strategy. [128,130] To encourage carry over to the home environment, a group discussion about how to stay in the routine of home practice was included in the final session of Loud and Proud. Strategies were not provided by the researchers, as routine is strongly influenced by individual circumstance, preferences and experience. [238] To promote carry-over, participants also nominated conversational activities as part of their home program each week during Loud and Proud. [130,152]

2.2.5.4 Feedback. The nature of feedback needs to be defined in the group design, and to be appropriate to the treatment goals. For maintenance therapy following on from LSVT LOUD®, it is necessary to continue with one cue, "loud", and continue to shape by example, in order to minimise cognitive load. [130] Searl et al. (2011) have demonstrated the feasibility of cueing for "loud" and using LSVT LOUD® exercises in a group format in primary intervention. Cueing for loud in a maintenance intervention should similarly be possible.

For a primary intervention, SPL and video feedback are highly appropriate, and have been employed to good effect in the LSVT LOUD® and by Robertson and Thomson. [229] However, regular acoustic monitoring of pitch and SPL is not feasible in a group setting. [23,149,152] Moreover, in a maintenance intervention, participants must be able to continue home practice and conversation without biofeedback. As such, Loud and Proud was designed such that the use of instrumental feedback was limited to a SPL monitoring once per fortnight, in order to ensure that loudness in the sustained vowel was at therapeutic and safe levels, according to the LSVT LOUD® protocol. [128]

An interactive environment was encouraged in Loud and Proud, with feedback provided both by the clinician and between participants. [229] Feedback between peers was explicitly discussed at the beginning of the group sessions. [237] Participants were advised that giving feedback to peers and receiving feedback from their peers was an integral part of the program, and each group negotiated how that would occur (for example, by online

verbal commentary, or the use of "diving numbers", or hand signals). The clinician also provided feedback as required during each session. It has been reported that people without disability benefit from nominating the trials on which they receive feedback. [240] However, as people with PD have sensory impairment, [130,159,160,241] they may underestimate the frequency with which they need feedback. Therefore, the feedback frequency in Loud and Proud was peer and clinician determined.

The group format also provided the opportunity for natural feedback, [23] such as a peer requesting repetition, or answering in a way that indicated he/she had misheard. Although the motor speech disorder literature lacks detail concerning the best method of providing feedback, it has been suggested that knowledge of performance assists early skill development, and a low frequency knowledge of result feedback schedule is preferable later in intervention, when a participant can assess their own performance. [242] All Loud and Proud participants had completed the LSVT LOUD® and therefore had been trained to improve their speech using one strategy. The skill of "loud" is well-developed during the LSVT LOUD®; as such, feedback was provided by clinicians as knowledge of results. A formal schedule for clinician feedback was not developed as it was anticipated that the required frequency of feedback would vary across participants. Clinicians were instructed to cue when participants were not sufficiently loud. [23]

A key aim for the program was for participants to develop the habit of monitoring their speech for effort and loudness. Participants reflected on their effort levels compared with success in activities via a workbook activity (discussed below). Given the common occurrence of people with PD feeling "too loud" when speaking at a normal conversational volume, [130] feedback from peers provided the benefit of validating that increased effort and loudness resulted in improved and appropriate sounding speech.

2.2.5.5 Group size and number of facilitators. Group size should be determined according to the goals of the intervention. [153,237] In order to allow sufficient conversational opportunities for each participant, [23] the group size of Loud and Proud was limited to six participants. This was consistent with the group sizes described for most studies in the literature. [149,152,229] Clinical practicality was considered in determining the number of facilitators. While most group therapy programs reviewed had more than one facilitator, [23,152,229] Loud and Proud was designed to be facilitated by a sole clinician in order to be resource efficient, and in recognition of the fact that many speech-language pathologists are sole practitioners. The group numbers allowed for an individual clinician to monitor the group. Unlike the group described by Robertson and Thomson [229], simultaneous sessions were not part of the design of Loud and Proud, avoiding the need for a second clinician.

The counselling provided in Loud and Proud is within the scope of speech pathology practice, [243] avoiding the requirement of a specialist counsellor, which was required for the design by Manor and colleagues. [152]

2.2.5.6 Group activities. The activities in Loud and Proud were chosen for both their relevance to the target behavioural changes, and for their appropriateness to people with PD. In choosing therapy tasks, enhancing patient motivation and engagement was a priority, as without motivation, learning cannot occur. [236,244,245] Client motivation leads to the allocation of cognitive resources to pursue goals, and is positively correlated with achievement. [245] A summary of the activities developed for Loud and Proud is presented in Table 2.

Table 2: Loud and Proud Activities

Activity	Description
Introduction	Welcome Discuss home practice from the previous week
Core Exercises	Single production of: • sustained /a/ • glide up • glide down • Functional Phrases in pairs
Tea	Continued practice of "Loud" speech over tea, coffee and biscuits
Reading in Pairs	Materials selected by participants
Paired Conversation Practice	Topics given by clinician, ranging in difficulty
Group Conversation	From topics set by participants in Week 1
Cognitive Load Activity	Activities that require "Loud" speech in addition to use of working memory
Independent Practice Tasks	Participants set goals for home practice during the week

***2.2.5.6.1 Introduction*.** In group therapy, the first session sets the standard for following sessions, and must be carefully facilitated. [237] The purpose and goals of the group must be articulated, and a sense of trust must be developed. [237] In the first Loud and Proud session, the purpose of the group as well as the expectations of behaviour within the group was discussed. In addition to addressing feedback (as discussed above), the

importance of confidentiality is conveyed. [237] The participants completed an "ice-breaker" activity (each participant provided the group with two facts and one fiction about their life, with the group guessing which was the fiction). Ice-breaking activities are useful in order to begin the formation of the group and create a warm and comfortable atmosphere. [237] The Loud and Proud participants supplied interests to serve as topics for later group conversations, and shared their "top tips" for people with PD, which provided an opportunity to promote the group's sense of connectedness and democracy. [237,246] Consistent with good group practice [237] and the theories of self-management, [247] participants were encouraged to provide leadership and contribute to their own and their peers' skill development during the intervention.

2.2.5.6.2 Core exercises. One repetition only of the LSVT LOUD® core exercises (sustained vowel, downward pitch glide, and upward pitch glide) was completed each week. Primarily, this was included to ensure that home practice of these exercises was accurate. Secondly, because competition within the group has also been reported to enhance performance, [23,149,152] it was hypothesised that participants would attempt to match the effort level of their peers, which would positively influence performance. Finally, it was intended that the core exercises would serve to remind participants of the required effort and loudness, and these, therefore, were completed near the beginning of the program. Similarly, Searl and colleagues [23] described the sustained /a/ as being an energiser and employed it to set effort levels in their group program. As previously mentioned, loudness was measured with a SPL meter every second week during the sustained vowel, in order to ensure volume was at safe and therapeutic levels.

2.2.5.6.3 Reading. Of group programs reviewed, the majority employed reading as an activity. [23,152,229] As this program was a maintenance program, reading commenced at the discourse level as participants had already progressed through a hierarchical increase in length of material as part of completing the LSVT LOUD® training. [128] Reading activities were completed in pairs early in the sessions after the core exercises, again to set the level of effort and loudness required and to ready the participants to use increased loudness and effort during the more challenging activities later in the session. Reading provided the opportunity to practise with limited cognitive load, [173] allowing participants to experience success, which was important for motivation and self-efficacy. [221,226,248]

Participants were able to select their own reading material from the resources, and those brought in from home in order to enhance saliency. Thus, participants were able to determine the level of difficulty of the material and to choose materials they would find motivating. Motor skill learning is enhanced when learners can select the difficulty of the

task. [249] Self-control of difficulty increases autonomy, and may positively influence motivation, more active participation, and "deeper" learning. [240]

2.2.5.6.4 Paired conversation. The program required participants to remain in pairs for the first conversational practice activity, to increase the opportunities for each participant to speak. Likewise, Searl and colleagues [23] used conversational dyads and triads to increase response frequency. Topics for the paired conversations were set by the researchers as part of the program and ranged in difficulty to provide opportunities for success as well as some challenge. [248] The clinician had flexibility in setting the topics, in order to meet individual participants' needs and interests. [248] Working in pairs provided a dramatic increase in background noise in the room, which served to replicate the noise with which people with PD compete in their own environments. [23]

2.2.5.6.5 Group conversation. Group conversation was included to replicate conversations commonly encountered in the naturalistic setting, such as family dinners, and social occasions. [23,152] This activity provided the opportunity to practise sustaining loudness and effort in the presence of the cognitive-linguistic load associated with conversation. [152,173] The group conversation topics were set by the participants during the first week to promote autonomy of the participants [245] and to ensure topics were salient. [245,248] Where required, the clinician facilitated involvement of individual participants if their response level was low.

2.2.5.6.6 Cognitive load activities. The final activity for each week required participants to maintain loudness and effort in speech in the presence of cognitive load to address the negative influence of distraction on speech in PD. [169] Examples of activities included deciding which of three definitions (presented verbally) for an unusual word was accurate and explaining why, and playing a rapid counting game where multiples of five or seven were replaced by the word "buzz". All tasks required the recall of information of extend length and/or the manipulation of cognitively held information while simultaneously speaking. [99,178,197] The aim was to provide opportunities to practise speaking in an environment where cognitive challenge extended beyond the requirements of everyday conversation.

2.2.5.6.7 Informal conversation. Manor et al. [152] noted the importance of providing informal conversational practice and the opportunity for socialisation, and allocated 15 minutes of their group time to informal conversation. Similarly, morning/afternoon tea was included in Loud and Proud for the same purposes. Participants were reminded that this period was not a "break" and were encouraged to maintain loudness and effort, and to

include in their everyday functional phrases a suitable phrase that related to this activity, such as "white and one" or "how do you take yours?".

2.2.5.6.8 The workbook. Participants completed a therapy workbook throughout each Loud and Proud session, which was monitored weekly by the clinician. During the first session, participants nominated their four most troublesome communication activities, and the importance of each of these activities. This direct link to life experience was included to increase motivation, in accordance with the principles of adult learning. [250] Independent, self-directed goal setting was encouraged to enhance participants' autonomy. [250] Motivation increases with an awareness that there is a discrepancy between the current situation and goals. [250] Each week, the participants completed the workbook, rating their success in their nominated activities and in their homework. The participants also rated their effort and success after each activity in the sessions. The process of recording behaviour on-line is important for self-judgement and the ultimate development of self-efficacy: it eliminates the effects of selective memory on assessment of performance. [237,251] The goal of the workbook was threefold: to encourage the participants to take responsibility for monitoring their own communication; to provide explicit instruction in the process of monitoring the level of effort required for success; and to allow participants to establish goals and track their success over the course of the group sessions. [236,237,244] The workbook provided a method for organising self-judgement, the comparison of performance against goals, and may have provided motivation for behavioural change. [237,251]

2.2.5.6.9 Resources. This group program was developed for use by clinicians in a variety of clinical settings, as recommended by de Angelis et al., [149] and as such required few resources. Materials included items readily available in clinic rooms: printed resources; a whiteboard or sheets of paper; name tags; and an SPL meter.

Motivation can be hindered by obtuse and non-salient resources. [245] Material and topics were selected to be as relevant and authentic as possible to people with PD. [153] Reading materials were taken from socially appropriate sources, such as newspapers and plays, and were also brought in by the participants. Much of the written material provided as part of the program was chosen for its potential to generate conversation and discussion, being controversial, unusual or humorous. Participants were able to select from a wide variety of topics. The majority of group conversation topics were determined in the first week by participants, in order to provide salient and enjoyable activities. The exceptions were conversations about "Top Tips for People with PD" and "What's Next". These topics were included to assist the participants to identify barriers, create plans for

managing them, and develop a plan for continuing progress and preventing deterioration, according to the principles of self-management. [218]

2.2.5.7 Treatment space. Large, accessible, private and comfortable group or conference rooms with ready access to tea and coffee making facilities were required for Loud and Proud. [229,237] Rather than the U-shape arrangement employed by Searl et al., [23] Loud and Proud participants sat at a large desk to allow eye contact during group activities. This was recommended to promote interaction, especially in the context of pragmatic deficits in PD. [176,177] Sufficient space and extra chairs were required in each room to allow for safe mobilisation of participants when breaking into paired activities. Initially, break-out rooms were considered for the paired activities; however, the groups were conducted in one room to take advantage of participants practising against multispeaker background noise. [23,158]

2.2.5.8 Family involvement. While the rationale for involving family and primary communication partners in interventions has been documented, [143,145,182] there is a risk that participants may have fewer opportunities to speak, compounding the reduction of within-session intensity associated with group interventions. [23,129] Consequently, spouses and family were not included in this pilot program, in order to maximise the intensity of the intervention within sessions. Maximising intensity was deemed especially important, given the interactive and conversational nature of the intervention.

2.3 Conclusions

Loud and Proud was an innovative group therapy program, specifically designed to extend and enhance the benefits of the LSVT LOUD®. The program was designed as an initial maintenance strategy following the LSVT LOUD®. Current theories of behavioural intervention were incorporated, including motor learning theory, promotion of neuroplasticity, and chronic disease self-management. The program also extended communication management for people with PD, to target speech during activities that are cognitively challenging and in group conversation. Chapter Three presents the results of a preliminary study describing the impact of Loud and Proud on the perceptual and acoustic features of speech in people with PD.

3. The Outcomes of Group Therapy for Maintenance of Speech following LSVT LOUD®: Study 1

Seventy to ninety percent of people with PD will present with hypokinetic dysarthria. [252] In addition, high-level cognitive-linguistic changes are commonly experienced by people with PD, making it difficult for them to engage in and maintain conversations.[31,80,104,176] The incidence and severity of hypokinetic dysarthria and cognitive-linguistic decline are known to increase with the progression of the disease. [253-258] Therefore, the maintenance of communication for people with PD should be an integral part of a clinical management program for this population. However, there remains limited evidence to inform clinicians, regarding the optimal nature and timing of a maintenance program. [144]

The impact of communication changes on the lives of people with PD needs to be considered within the *International Classification of Functioning, Disability and Health* (ICF) framework, which describes the complex interaction between impairment, activity limitation, and participation restriction. [17] The framework also accounts for positive and negative factors across the domains of body integrity, participation in activities and environmental factors. [17,259] Ongoing management is indicated in order to enhance quality of life. Assessment and intervention must extend beyond the clinic room, and consider the impact of the individual's communication disorder on his/her life, as well as the positive and negative influences unique to the individual's abilities. [1,3]

The evidence for use of the LSVT LOUD® as the primary intervention for the speech disorder evident in PD is strong. [130] While the positive effects of the LSVT LOUD® can last for up to two years, [125,126] these treatment effects may fade over time due to the progressive nature of PD. In addition, environmental factors impact on communication in PD, as described in Chapters 1 and 2. The cognitively challenging nature of the home environment on speech in PD must be considered by clinicians that work with people with PD. Is it possible to provide an intervention that renews the positive treatment effect of primary therapy that at the same time extends the complexity of the tasks to meet these challenges of the naturalistic setting? While it could be so postulated, there has been limited research investigating the most optimal ways to maintain everyday speech performance over time following individual therapy in the clinical setting. As discussed in Chapter 2, one potential model is the use of group therapy to provide a more challenging

and naturalistic practice environment, in order to maintain the benefits gained from intensive individual therapy.

There has been limited attention afforded to group therapy for dysarthria associated with PD in the literature, especially with regards to the use of this form of intervention as a maintenance strategy. The existing small scale studies of group therapy as a primary treatment or adjunct to primary treatment for dysarthria in PD were summarised in Chapter 2, section 3. These studies returned positive results with regards to improving intelligibility, loudness, and self-perception of communication ability, [145,149,152,229] as well as demonstrating the feasibility of completing tasks from the LSVT LOUD® in a group setting. [23]. However, there is a need to examine the effectiveness of various forms of group therapy as a maintenance strategy for people with PD, at different points in their disease progression.

Determining the efficacy of a specific treatment program requires "pre-trial" or Phase 1 studies in which hypotheses are determined, and the treatment protocol and outcome measures are defined. [260] The primary aim of this Phase 1 study was to explore the perceptual and acoustic speech outcomes following a specifically designed group therapy for people with PD who have completed intensive individual speech therapy. A second aim was to determine the impact of the group therapy on communicative effectiveness and quality of life in persons with PD. Following participation in the group therapy program, it was hypothesised that people with PD would demonstrate improvement in vocal loudness and speech intelligibility in conversation, with associated improvements in communicative effectiveness and quality of life. Thirdly, the study aimed to examine the impact of dysarthria severity on intervention outcomes. The fourth aim was to define the treatment protocol with respect to group activities and delivery schedule in preparation for future controlled research studies.

3.1 Method

3.1.1 Participants

Thirteen individuals with idiopathic PD as diagnosed by a neurologist were recruited to the study in response to advertisements in a PD association publication, and to flyers provided by neurologists and speech-language pathologists (included as Appendix B). One participant developed a neurological condition unrelated to his PD after commencing the study and was subsequently excluded from data analysis, reducing the sample size to 12 participants. A summary of demographic data for the participants is reported in Table 3.

The average age of participants was 70.42 years (range: 60 – 76 years; *SD* = 5.15) with the mean time post-diagnosis being 7.83 years (range: 2 – 16 years; *SD* = 4.53). All participants in the study presented with hypokinetic dysarthria. Dysarthria severity level was determined by a consensus rating of the participants' speech intelligibility in pre-recorded monologue and conversation samples by two experienced speech pathologists based on the following scale:

- *Mild.* Intelligible, some subtle perceptible changes evident or reported in speech e.g. difficulty being heard in noisy environments. Minimal effort required to understand speech.
- *Mild to moderate.* Mostly intelligible, occasional words difficult to understand. Occasionally has to repeat. Some effort required to understand speech
- *Moderate.* Intelligibility is reduced. Greater effort is required to understand. Participant very often has to repeat.
- *Moderate to severe.* Occasional words are decipherable. Speech is difficult to understand most of the time. Intelligible only in context.
- *Severe*. Speech is unintelligible.

The participants' intelligibility ratings are reported in Table 3. Four participants were rated as mild, five as mild-moderate, one as moderate, and two as moderate-severe. All participants had previously completed the LSVT LOUD® with a mean time since completion of 2.06 years (range: 0.25 - 3.75 years; *SD* = 1.25). The participants' level of clinical disability was rated according to the Hoehn and Yahr Staging Scale. [261] Two participants presented with unilateral PD symptoms (Stage I), four with bilateral or midline involvement but with preserved balance (Stage II), three with mild to moderate disability (Stage III), and three with fully developed and severely debilitating disease (Stage IV). One participant had undergone deep brain stimulation (DBS).

Inclusion criteria included: a diagnosis of idiopathic PD; completion of the LSVT LOUD® at least three months previously; a stable and optimal medication regimen as determined by their treating neurologist; and sufficient English proficiency to participate in the group activities. One participant was identified as having learned English as a second language, and was included in the study based on the assessing speech-language pathologist's judgement that his language would not impact on his capacity to participate in treatment. Exclusion criteria included: the presence of a neurological disorder in addition to PD; a voice or speech disorder inconsistent with PD; dementia; or a history of alcohol or drug abuse.

In addition to the participants with PD, 13 primary communication partners were recruited to the study to provide information about their respective partner's communication ability before and after treatment. One communication partner's PD spouse acquired a neurological disorder unrelated to his PD, and two communication partners were unavailable at follow-up, reducing the number of the primary communication partners to ten. All PD participants and their primary conversation partners received a written information sheet and were required to sign a written consent form prior to participation in the study. The study was approved by a University Medical Research Ethics Committee and the Health Research Ethics Committees of two metropolitan public hospitals.

Table 3: Participant Demographics

Participant	Gender	Age	Severity of Dysarthria	Time Since PD Diagnosis	Time post-LSVT LOUD®	Hoehn & Yahr	DBS
1	Female	76	mild-mod	4 years	3 years	4	No
2	Male	71	mod	7 years	3 years	3	No
3	Male	70	mild	6 years	3 years	1	No
4	Female	76	mild	5 years	3 years	2	No
5	Male	73	mild-mod	14 years	1 year	2	No
6	Female	62	mild	7 years	1 year	4	No
7	Male	70	mod-sev	16 years	3 years	4	Yes
8	Male	70	mild-mod	13 years	4 years	2	No
9	Male	60	mod-sev	2 years	6 mths	2	No
10	Male	74	mild-mod	11 years	2 years	3	No
11	Female	75	mild	5 years	3 mths	3	No
12	Male	68	mild-mod	4 years	1 year	1	No

Hoehn & Yahr = Hoehn and Yahr Staging Scale [261]; DBS = Deep Brain Stimulation; mod = moderate; sev = severe; mths = months

3.1.2 Procedure.

The study used a pre-post intervention research design. Participants completed baseline assessments on two separate days of the week prior to the intervention treatment, and then post-therapy assessments on two separate days. The acoustic data

for the two pre and post assessments were averaged, to provide mean pre-and post-assessment scores which were then used in the statistical analysis. Samples for perceptual comparison were taken from the second assessment pre- and post-therapy. Participant and communication partner ratings of quality of life and communicative effectiveness were collected once before and once after therapy.

The researcher conducted the assessments for Participants 1 to 9. Participants 10 to 12 were assessed by two research speech pathologists, to allow the researcher to conduct the intervention for these participants. The group therapy for participants 1 to 9 was conducted by LSVT® accredited research assistants, trained in the delivery of Loud and Proud. To ensure consistency across assessors, a standard protocol was used for collection of the acoustic and perceptual measures and assessors were trained in the use of this protocol prior to the administration of the assessments. The quality of life and communicative effectiveness measures were administered according to the procedure outlined in the respective manuals.

Primary outcome measures included sound pressure level (SPL), duration of sustained vowel production, and maximum frequency range of the voice. SPL was measured during sustained phonation, reading, a 90-second production of a monologue, and a five-minute conversation with the assessor. These measures were selected as they were directly relevant to the group intervention's primary aim of maintaining the increase in speech loudness and effort following the LSVT LOUD®. [120,134,214] Secondary outcome measures included ratings speech intelligibility, communicative effectiveness and quality of life. Participants were assessed in a quiet space in their own homes to reduce the burden of travelling to and from the clinic and to mitigate any performance effect that could occur within a clinical setting. [173] All assessments were completed by a speech-language pathologist not involved in the delivery of the intervention. The group therapy intervention comprised eight 90-minute sessions, conducted once per week for eight weeks. The groups were restricted to a maximum of six participants in order to ensure sufficient clinical supervision and to maximise each participant’s time speaking. There were four intervention groups. One group had four participants, and three groups were comprised of three participants each.

3.1.3 Primary Outcome Measures.

3.1.3.1 Vocal amplitude, duration and frequency. Vocal SPL was collected using a DSE Q1362 SPL meter, situated 30 cm from the participant’s mouth, as described previously. [49] The distance between the participant and the equipment was regularly

checked during the assessment. Participants were instructed to produce a sustained /a/ for as long as possible, six times each assessment, during which SPL was recorded, and the duration of the sustained vowel (seconds) was also documented and averaged. SPL was also measured while the participants read the first two paragraphs of the Rainbow Passage. [147] For the monologue, SPL was recorded as participants spoke for 90 seconds about a time they felt extremely happy. The instructions were to recall that time with great intensity, and to try to actually relive that moment. [128] These instructions were chosen to provide similar monologues across points in time, in order to avoid confounding influences in the perceptual assessment of the samples. The assessor then continued to record SPL while conversing with the participant for five minutes to collect a conversational sample.

The frequency range of the voice was measured using a BOSS TU-80 pitch meter, which recorded a musical note. This level was converted to Hertz using a conversion table. [262] Participants were asked to phonate stepwise from their modal pitch to their highest vocal pitch and sustain this level for three seconds. This task was repeated six times per assessment. Participants then phonated stepwise six times to their lowest possible pitch.

3.1.4 Secondary Outcome Measures.

3.1.4.1 Perceptual assessment. Speech recordings of the participants producing the monologue were collected using an Olympus VN-240PC digital voice recorder, situated 40 cm from the participant's mouth. The samples were collected and re-played as WAV files. Two speech-language pathologists, experienced in the treatment of adults with motor speech disorders, conducted paired comparison ratings of speech intelligibility on these speech samples. Both speech-language pathologists were native English speakers and reported normal hearing. The listeners were presented with 15 second samples from the monologue taken from the second assessment before and after the intervention. The second recording was selected to mitigate the potential of task novelty influencing performance at the first pre-intervention assessment. The listeners were presented with the samples for every participant with the first presentation randomised between the pre-treatment and post-treatment sample. A second block of samples from every participant was presented in the reverse order. The listeners were given the following instructions, adapted by Wenke [263] from the work of Sapir et al. [127]:

> *You are going to hear pairs of audio samples. You will be deciding which speech sample, the first or the second, is easier to understand. On your paper, you will write the letter A if you think the first sample is easier to understand or the letter B if you think the second sample is easier to understand. If you think*

there is no difference between the samples, then you would write the word "same". You are only ever comparing two speech samples with each other. Do not compare one speech sample to any of the previous samples you hear. You should listen to each sample using a "fresh ear".

In order to allow for quantitative evaluation, the listeners also reported the magnitude of the change from -50 to 50. A visual analogue scale was provided on the score sheet, with 'much better' being a score of 50, the "same" being a score of 0, and "much worse" being a score of -50. [22]

Will you please also indicate how much easier (or vice versa) the second sample is to understand, from 0 – 50. A score of 0 means both samples sound equally clear, a score of 50 means the second sample is much better, and a score of -50 means the second sample is much worse.

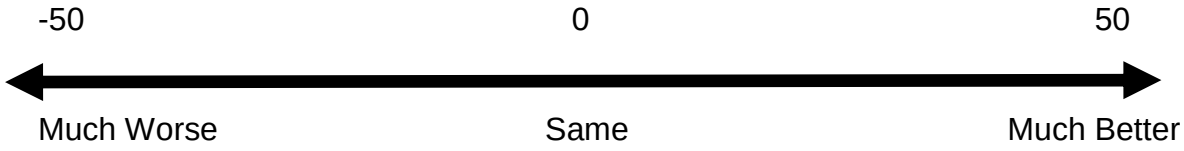


Figure 1: Visual analogue scale for listener assessment

3.1.4.2 Communicative effectiveness. Communication partners recruited to the study completed a modified version of the Communicative Effectiveness Index pre- and post-treatment (CETI). [264] The assessment was modified for people with PD; the term "stroke" was replaced with "Parkinson's disease" on the response form. The CETI was administered according to the manual. Accordingly, communication partners were able to see their pre-therapy ratings at the time of their final rating. The CETI was selected in order to provide a communication partner assessment of communicative effectiveness and because of its strong psychometric properties, including construct validity and test-retest and inter-rater reliability. [265]

3.1.4.3 Quality of communication life. Participants completed the ASHA Quality of Communication Life Scale (QCL) [266] pre- and post-treatment. The impact of communication disability on personal relationships, social life, autonomy, well being, and participation (social, leisure, work and education) was assessed. [266,267]The QCL was selected due to its validity and reliability, and because the visual analogue scale allows participants with hypographia (a common complication in PD) to complete the assessment independently.

3.1.5 Group Therapy

The group therapy program called Loud and Proud, outlined in Chapter 2, Section 2.5, was an eight-week maintenance program for speech in PD following completion of the LSVT LOUD®. Participants attended a 90-minute group session once per week over the eight weeks. The group therapy was conducted in conference rooms at three metropolitan hospitals and a university, set up to enable group and paired activities, as described in Chapter 2, Section 2.5.7.

Delivery of the intervention as a group was intended to provide a naturalistic and challenging communication environment. The rationale, background and design for the group was described in Chapter 2. In the first week, the group negotiated the method for offering feedback, and determined topics for group conversations. In subsequent weeks, each session commenced with a discussion of the previous week's home practice. The opening section of the group sessions is described in Section 2.5.6.1. The LSVT LOUD® core exercises were briefly revisited after each session's introduction, with loudness measured with a SPL meter every second week, as described in Section 2.5.6.2. The majority of the group time consisted of reading practice in pairs, followed by conversation in dyads and as a group, and then a group activity as described in Section 2.5.6. In addition to the therapy tasks, participants completed a therapy workbook each week. This activity enabled participants to track their performance in therapy, and their progress towards their communication goals, as described in section 2.5.6.8. In order to encourage ongoing independent practice, the participants were also expected to complete the maintenance practice as prescribed by the LSVT LOUD® program.

3.2 Results

3.2.1 Statistical analysis.

The statistical analyses of all measures were conducted using SPSS software Version 21. [268] The SPL measures, maximum frequency range, and duration of sustained vowel production were compared pre- to post-therapy using paired *t*-tests. The Cohen's *d* statistic was calculated to determine effect size for the acoustic data. [269] Initially, a descriptive analysis of the listener's perceptual ratings was completed. The perceptual ratings were then tested against the null hypothesis using a one-sample *t* test. Inter-rater reliability for the perceptual raters was tested using intraclass correlation – average measures. [22,270] Intra-rater reliability was calculated using intraclass correlation – single measures for each listener's ratings across the two presentations. [270] Pre-post

comparisons for the QCL and CETI results were conducted using the Related-samples Wilcoxon Signed Rank Test. Effect size for the QCL and CETI results was calculated according to the method described by Hirsch, Keller [271] ($z / \sqrt{n1 + n2}$). An alpha level of 0.05 was applied for statistical significance for all measures. An effect size of 0.20 was considered to be small, 0.50 to be medium, and 0.80 to be large. [272]

Prior to statistical analysis, an examination of the raw data identified an outlier in the maximum frequency range data (Participant 6). This value was subsequently excluded from the data set for this measure. Due to equipment failure, two monologue samples were not available for perceptual assessment, reducing the number of comparisons to 10. Data was missing for one participant with mild dysarthria (Participant 12) and one participant with mild-moderate dysarthria (Participant 10). Two conversational partners were unavailable at post assessment, reducing the returned CETI questionnaires to 10. One participant was unable to complete the QCL during the final assessment due to time constraints, resulting in 11 returned QCL ratings.

In order to examine the impact of dysarthria severity on intervention outcomes, a descriptive analysis of individual performance (grouped by severity level) post-intervention across all measures was undertaken.

3.2.2 Primary Outcome Measures

Table 4 summarises the group mean scores for the primary outcome measures before and after participating in Loud and Proud. There was a statistically significant increase in SPL for sustained vowel production, reading, monologue, and conversation following the group therapy. There was a small effect size for the increase in dB in the sustained vowel task, and a small to medium effect size for the increase in dB in the reading, monologue and conversation conditions. No significant differences were obtained for maximum frequency range and duration of the sustained vowel production pre- to post-therapy. Likewise, the effect size was negligible for the change pre to post for these measures.

Table 4: Comparison of SPL, Frequency Range, and Vowel Duration Pre- and Post-Loud and Proud.

Parameter	Pre (SD)	Post (SD)	post-pre	*df*	*t*	*p*	*SE*	95% CI	*d*
Vowel dB	80.16 (6.16)	82.04 (5.66)	1.88	11	2.31	0.042*	0.81	0.09 – 3.68	0.30
Reading dB	66.73 (5.48)	68.67 (4.56)	1.94	11	2.57	0.026*	0.76	0.28 – 3.60	0.36
Monol dB	63.33 (6.04)	65.73 (5.01)	2.39	11	2.88	0.015*	0.83	0.56 – 4.22	0.40
Conv dB	63.46 (5.65)	65.66 (4.93)	2.20	11	2.55	0.027*	0.87	0.30 – 4.11	0.38
Max Freq range (Hz)	162.73 (129.05)	161.90 (100.81)	-0.82	10	0.06	0.950	12.93	-27.99 –29.63	-0.01
Vowel duration (s)	15.74 (5.39)	15.11 (5.92)	0.63	11	1.08	0.304	0.59	-0.66 – 1.92	-0.10

* $p < 0.05$ two-tailed; *monol = monologue; conv = conversation; max freq = maximum frequency; s = seconds; d = Cohen's effect size*

Figures 2 to 8 display the difference scores for the primary outcome measures pre- to post-intervention for each participant grouped by dysarthria severity. Figure 2 shows the change in sustained vowel SPL per participant. Although 10 of the 12 participants demonstrated increases in SPL following the intervention, these increases were small, ranging from 0.77 to 5.57dB.

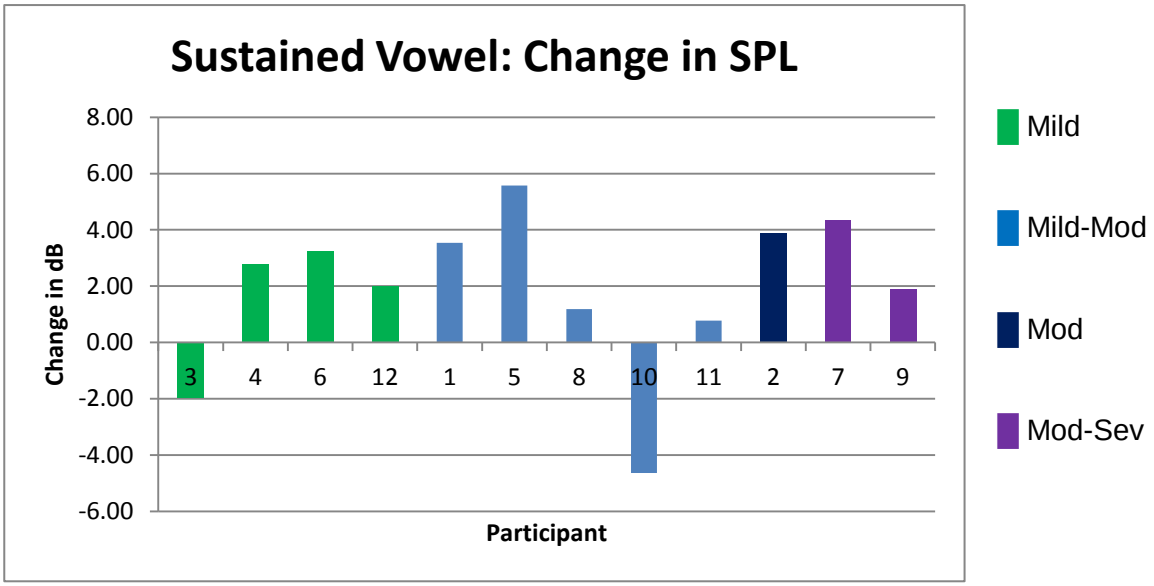


Figure 2: Change in SPL during the sustained vowel task pre- to post-therapy, by participant, grouped by dysarthria severity.

The change in SPL during reading is presented for each participant in Figure 3. Four of the 12 participants (4,1,5,2) demonstrated modest increases in SPL on this task with seven participants (3,6,12,8,11,7,9) achieving minimal increases. Performance was noted to vary across the dysarthria severity groups.

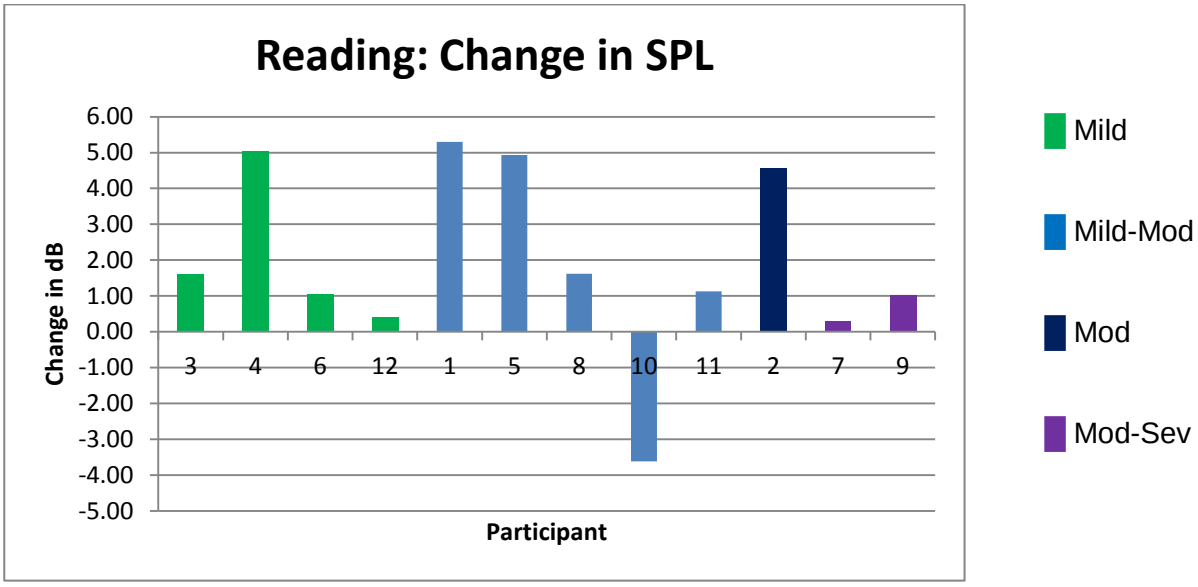


Figure 3: Change in SPL during reading pre- to post-therapy by participant, according to dysarthria severity.

The changes in SPL pre- to post-intervention on the monologue task are presented in Figure 4. The majority of changes were minimal to modest, with the exception of

Participant 5 (with mild to moderate dysarthria) who demonstrated a 5.71dB increase, and Participant 2 (with moderate dysarthria) who demonstrated an increase of 8.90dB during a monologue task.

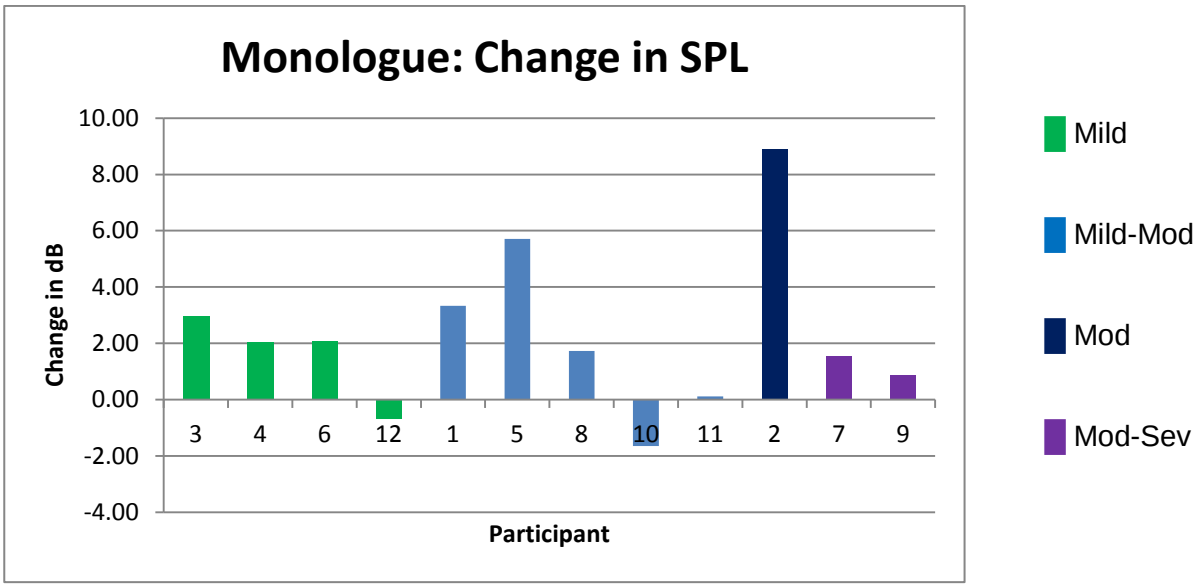


Figure 4: Change in SPL during monologue production pre- to post-therapy, by participant, according to dysarthria severity.

The change in SPL in conversation pre- to post-therapy is presented in Figure 5. Five participants (3,6,1,5,2) across three severity levels demonstrated a higher SPL after the intervention, with another five participants (4,12,8,7,9) in similar severity groups demonstrating only minimal change.

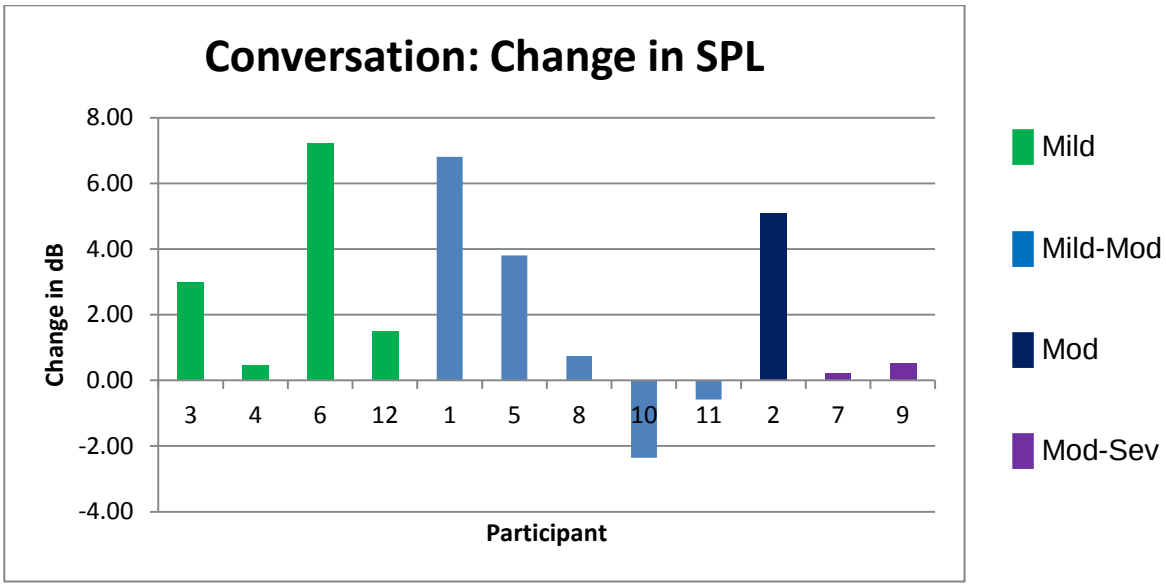


Figure 5: Change in SPL during conversation pre- to post-therapy, by participant, according to dysarthria severity.

The change in duration for the sustained vowel is reported in Figure 6 for each participant. Increases in duration post-therapy were minimal for five participants (3,8,10,11,9) and decreased in seven participants (4,6,12,1,5,2,7). Performance varied substantially across severity groups.

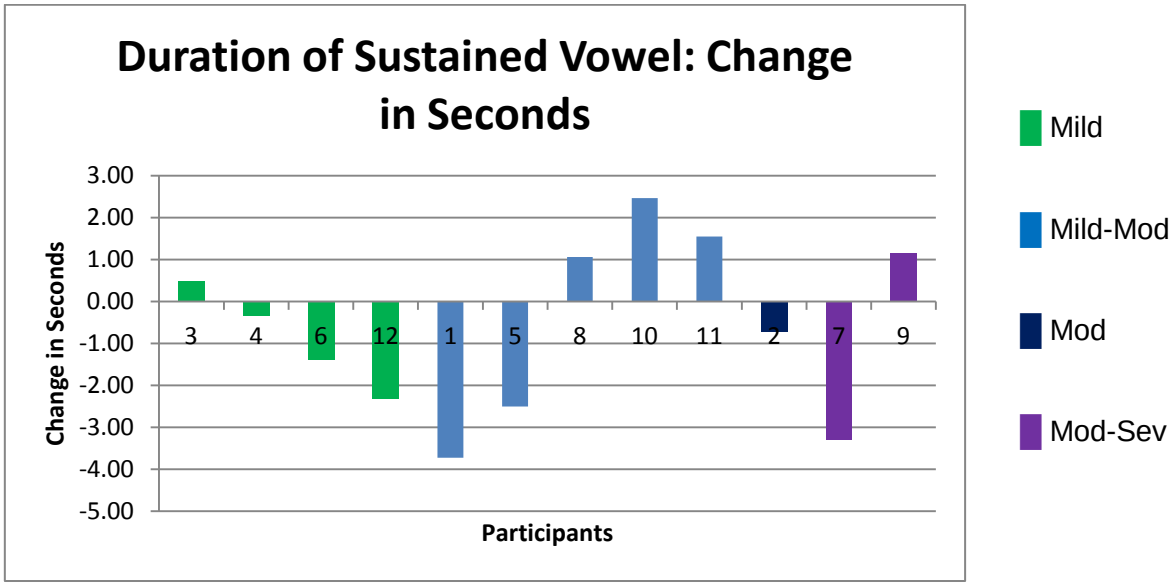


Figure 6: Change in duration of sustained vowel pre- to post-therapy by participant, according to dysarthria severity.

The change in maximum frequency range is reported for each participant in Figure 7. Minimal changes in maximum frequency range were identified following intervention in nine participants (3,4,12,1,5,8,10,2,9). One participant (7) from the moderate-severe dysarthria group demonstrated a modest increase in maximum frequency while participant 11 with mild to moderate dysarthria revealed a modest decrease on this measure.

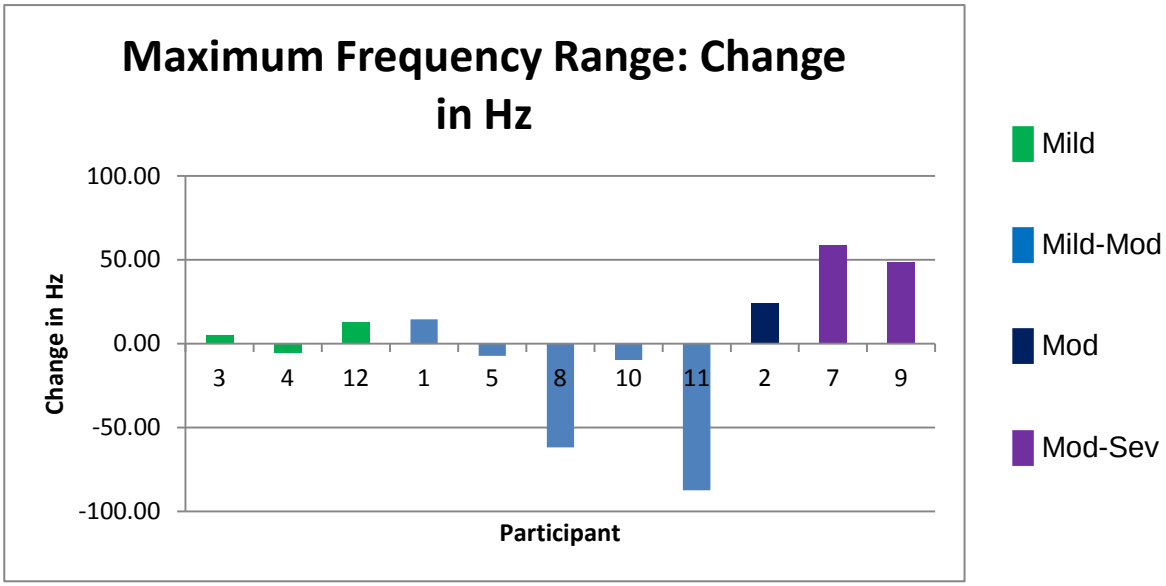


Figure 7: Change in maximum frequency range pre- to post-therapy, by participant, according to dysarthria severity.

3.2.3 Secondary Outcome Measures.

Table 5 reports the results of the perceptual ratings. PD participants were rated as being easier to understand post-intervention for 12 (30%) of the 40 presentations, pre-intervention for 4 (10%) of the 40 presentations, and were rated as the same pre- to post-intervention for 24 (60%) of the 40 presentations. Two of the 10 participants (1,5) were rated as more intelligible after intervention by both raters. Inter-rater reliability was excellent ICC = 0.728, p = 0.033; [273]. Intra-rater agreement was also excellent for both Rater 1 (ICC = 0.884; *p* = 0.002) and Rater 2 ICC = 0.889; p = 0.002; [273]. The mean improvement in listener ratings pre- to post-intervention was 4.13 (range: -15 – 50), but did not reach statistical significance (*p* = 0.051).

Table 5: Perceptual Ratings

Participant	Rater 1 First Rating	Rater 1 Second Rating	Rater 2 First Rating	Rater 2 Second Rating	Value: Rater 1	Value: Rater 2	Average Value
1	post	post	post	post	10	7.5	8.75
2	same	same	same	post	0	2.5	1.25
3	same	same	same	same	0	0	0
4	post	post	same	same	10	0	5
5	post	post	post	post	50	17.5	33.75
6	pre	pre	same	same	-12.5	0	-6.25
7	pre	post	same	same	2.5	0	1.25
8	same	same	same	same	0	0	0
9	same	same	same	pre	0	-5	-2.5
11	same	same	same	same	0	0	0
				Group Average:			**4.13**
							(SE = 3.52)

Notes: value = average numerical magnitude value per rater; average = average magnitude rating.

Figure 8 shows the average perceptual rating change for each participant, according to dysarthria severity. The two participants (1,5) who were judged to be easier to understand post-intervention had mild to moderate dysarthria.

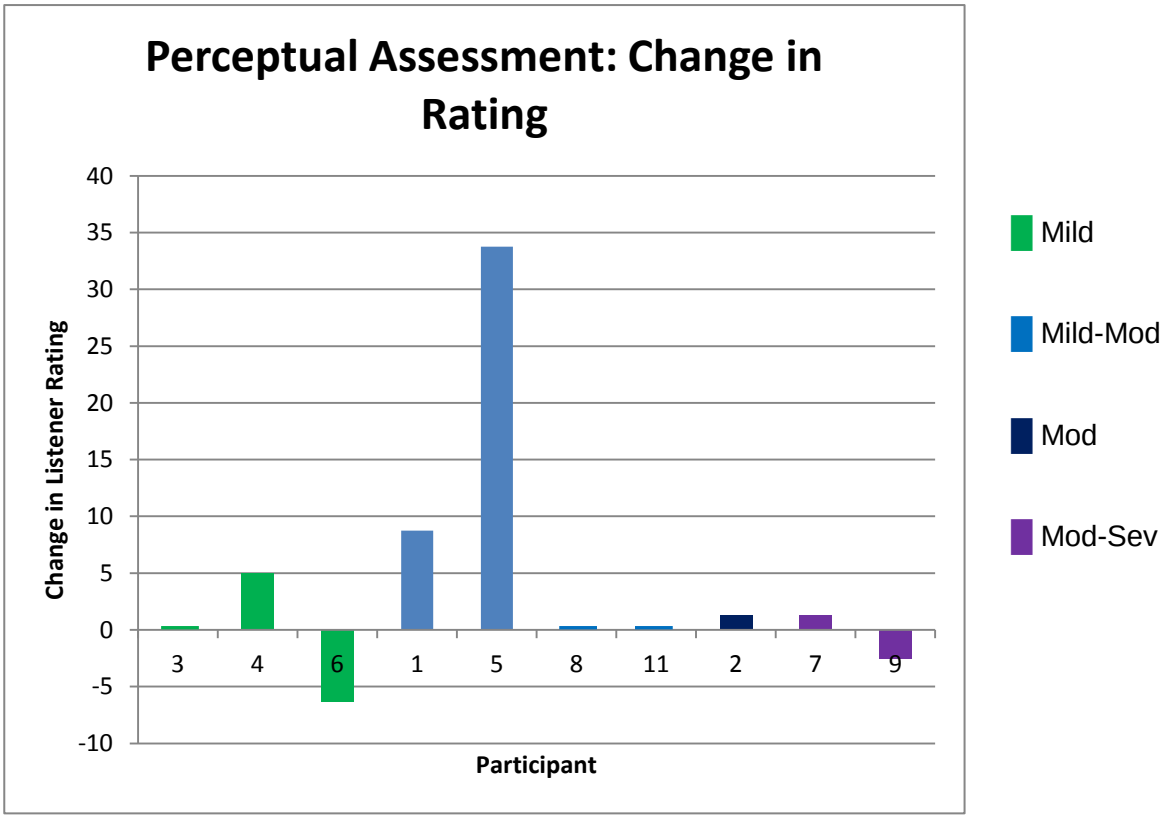


Figure 8: Change in perceptual rating of intelligibility pre- to post-therapy, per participant, according to dysarthria severity.

Table 6 reports the group mean differences for measures of communicative competence (CETI) and quality of life (QCL). There was no statistically significant change for either measure following the intervention. There was a small to medium effect size for the change in CETI rating post-intervention, and a small negative effect size for the change in QCL rating.

Table 6: QCL and CETI Measures Pre- and Post-Loud and Proud

Parameter	Pre	Post	Difference	*N*	Interquartile Range	Sig.	Effect Size
CETI	67.75	71.09	3.34	9	5.34	0.091	0.38
QCL	4.09	3.99	-0.10	11	0.71	0.350	-0.20

* $p \leq 0.05$ two-tailed

Figure 9 presents the change in CETI results for each participant pre- to post-intervention, according to dysarthria severity. The two communication partners unavailable

at follow-up were partners of people with mild-moderate dysarthria, reducing the returned surveys for the mild-moderate group to three. Six of the 10 communication partners returned marginally higher ratings post-Loud and Proud, three scored PD participants the same as prior to the intervention, and one rated the PD participant as slightly less effective than before group therapy.

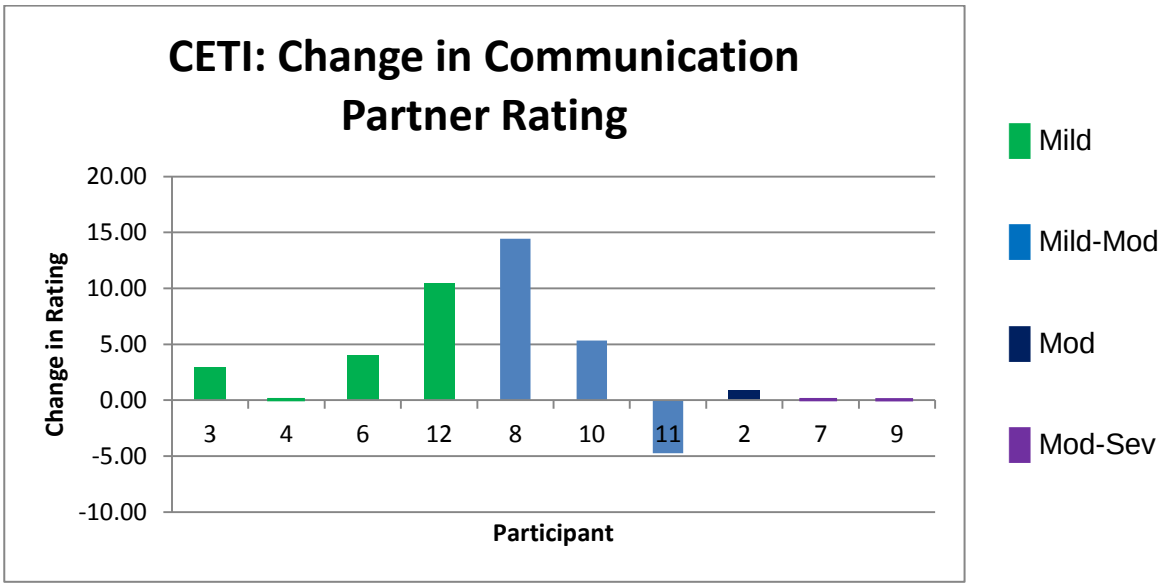


Figure 9: Mean change in CETI pre- to post-intervention, per participant, according to dysarthria severity.

The QCL results for each participant are presented in Figure 10. The changes were negligible across the participants in each severity group.

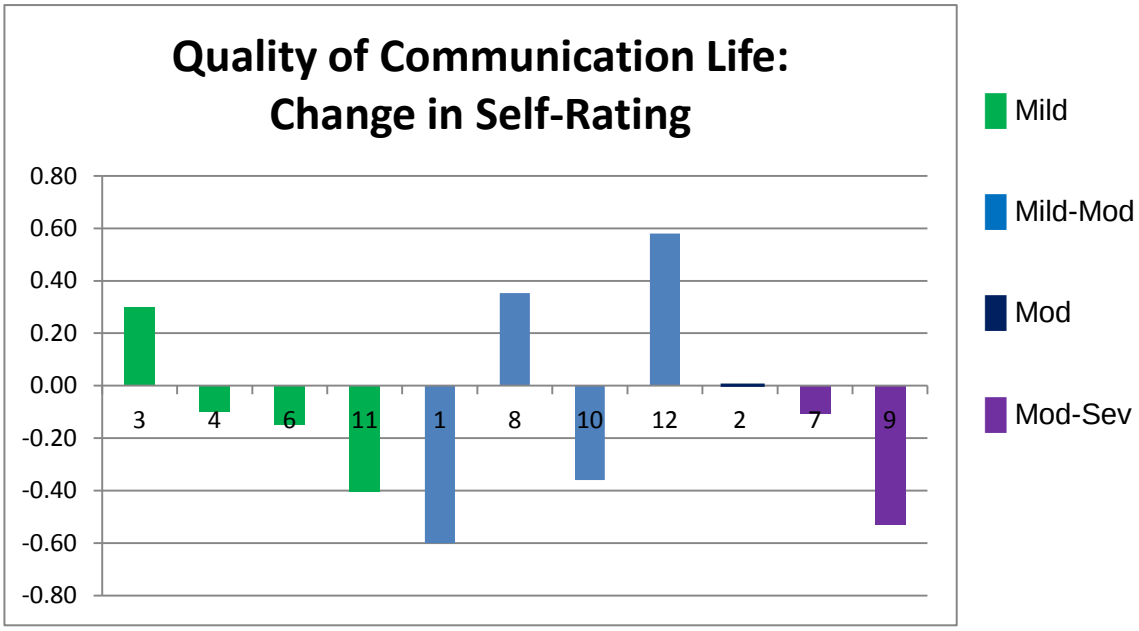


Figure 10: Mean change in QCL pre- to post-intervention, per participant by dysarthria severity.

3.3 Discussion

The results of this exploratory study revealed statistically significant increases in loudness in the speech of participants following completion of the eight-week Loud and Proud group therapy treatment. Although the effect sizes were small to medium, these increases of approximately 2dB were not clinically relevant, and the SPL of the participants remained below that of their healthy peers. [49] Furthermore the increases in loudness were not accompanied by significant improvements in perceived speech intelligibility, vocal frequency range, duration of phonation, quality of communication life, or conversation partner ratings of communicative effectiveness.

Caution must be applied when considering the outcomes with respect to dysarthria severity, due to the small numbers in the groups. There was a high degree of variability in treatment response across participants, consistent with previous reports of behavioural interventions in PD [114]. The variability in response to Loud and Proud was not explained by the participants' baseline dysarthria severity. The study identified three core improvements to the Loud and Proud protocol in order to improve participant outcomes.

3.3.1 Group data.

The healthy population has been reported to have a SPL in excess of 70dB in monologue and picture description tasks. [49] The final SPL of the participants in this study remained below the normal threshold during reading, monologue and conversation.

Similarly, SPL endpoints for this study's participants remained below that previously reported following LSVT LOUD®. Immediately following the LSVT LOUD®, SPL in monologue has been reported to be approximately 69dB. [120,134] After Loud and Proud, this study's participants averaged 65.59dB in monologue. The difference in reading was even more marked, with LSVT LOUD® participants reaching approximately 74-75dB after treatment [120,134]; in contrast, this study's participants' mean SPL in reading was 68.67dB after intervention. The average time since diagnosis of PD was noted to be similar between the current study and Ramig. The time since diagnosis was 7.8 (*SD:* 4.53) for this study and 8.3 years (*SD*: 9.3) and 6.55 years (*SD:* 5.25) in Ramig et al's 1995 and 1996 studies, respectively. This study's PD participants also demonstrated a similar dysarthria severity to the LSVT LOUD® cohort, prior to intervention. [120,134] While improvements in SPL were noted following Loud and Proud, the participants did not reach the SPL reported for participants immediately following the LSVT LOUD®.

One explanation for this finding was the dosage of treatment used in the current study. The weekly group format of Loud and Proud may not have been of sufficient intensity to fully recalibrate the participants' vocal loudness and effort in speech. [23] Another consideration was the average time post-LSVT LOUD® for the participants in this study, that is, approximately two years (ranging from three months to four years). It is possible that an extended length of time between primary and maintenance intervention impacted on the participants' responsiveness to maintenance therapy. It may be that too long a period had elapsed between primary intervention and the provision of maintenance intervention to effectively treat participants in a weekly group format. Previous research has shown that the effects of the LSVT LOUD® last up to two years. [122] Seven of the 12 participants in the current study had completed the LSVT LOUD® more than two years prior to commencing Loud and Proud. Weekly group therapy may not be sufficiently intensive once the effects of the LSVT LOUD® have faded.

However, Searl, Wilson [23] provided weekly group therapy for their previously untreated participants, and the resulting group mean SPL post-intervention for reading and monologue was approximately 70dB. Searl and colleagues implemented a more intensive home practice schedule than that of Loud and Proud, which increased the intervention dose, and may have resulted in the more favourable SPL outcomes. Another possible explanation for the differences noted between the current study and that of Searl et al. relates to the types of activities used in the intervention. Loud and Proud activities were designed to continue the hierarchy of difficulty of activities from the LSVT LOUD®, and included reading at the discourse level, group conversation practice and tasks with

cognitive load. The addition of cognitive distraction in Loud and Proud may have hindered recalibration of loudness and effort for participants, especially considering the extended length of time that had elapsed for many of the participants since their completion of the LSVT LOUD®. Future research should explore the effects of cognitive load and time between primary and maintenance intervention.

Alternatively, the testing methodology may partly explain the results. The assessments for this study's participants were undertaken in the home environment, rather than in the laboratory, in order to assess performance outside of the clinic room and to reduce the burden of travel for participants. People with PD are reported to be less intelligible in informal environments than they are in the clinic room. [118,173,174] It is possible that testing in a laboratory may have prompted Searl et al.'s participants to use the strategies they had recently learned in therapy, whereas in the current study, participants may have demonstrated more real-world performance. Further research is required to fully explore treatment outcomes in the home environment of people with PD.

It is not possible to directly compare the results of the current study to previous investigations of group therapy for people with PD. The majority of these previous studies were provided as a primary intervention. [23,145,149,229] While Manor and colleagues (2005) provided a similar therapy dose, and provided group therapy as a follow-up to individual therapy, SPL measures pre- and post-therapy were not available for comparison. Future studies should investigate the impact of group therapy treatment on SPL, and investigate the timing, frequency and dose of intervention for optimal maintenance.

In this study, maximum frequency range was unchanged following intervention. There was also no significant difference in the duration of sustained vowel production pre- to post-intervention. Prior to intervention, the participants' duration of sustained vowel production was approximately 15 seconds, which was comparable with previous reports of non-dysarthric participants of comparable age, [274] and a ceiling effect may have influenced performance on this task. Although sustained vowel production and frequency range tasks were not trained in Loud and Proud, participants did perform a sustained vowel and the step-wise pitch exercises once per session, and practised the exercises as part of their home program. Training these tasks in the group sessions or increasing the intensity of the home program may have resulted in better outcomes post-therapy. Future research should consider the ongoing need to include these exercises as part of a maintenance group therapy program.

Congruent with the marginal group improvements in SPL during conversation and monologue, there were no concomitant improvements in perceived speech intelligibility, or

communication partner ratings of communicative effectiveness. The increase in SPL following Loud and Proud may not have been sufficient to result in discernible improvements in speech intelligibility as determined on a monologue task. It is also possible that, as previously discussed for SPL, the time post-LSVT LOUD® for these participants may have degraded the lasting effect of LSVT LOUD® on intelligibility [127] such that the cumulative effects of Loud and Proud were insufficient to result in a perceivable change.

Consistent with the findings of Miller et al., [30] the communication partners' pre-assessment CETI results indicated a perceived deterioration of communicative effectiveness compared with the participants' abilities prior to the diagnosis of PD. Communication partners who perceive no difference in their partners' communicative effectiveness since diagnosis return a score 100 on the CETI. The average CETI rating pre-intervention for the participants in the current study was 67.75. The CETI results post-therapy indicated there was no significant change to the communication partners' rating of the participants' communication abilities after intervention. These findings were consistent with the modest increases in SPL and the lack of significant improvement in perceived speech intelligibility.

The QCL results revealed there was no substantial change to the participants' perception of their communication quality of life following the intervention. The mean QCL score was slightly lower following intervention, indicating a worsening of perception of quality of communication life. It is likely that improvements seen in SPL following Loud and Proud do not translate to improvements in everyday life. This finding is consistent with the failure to record significant improvements in either speech intelligibility or communication partner ratings of communicative effectiveness. Another possible influence on the participants' assessment of quality of communication life is an enhanced awareness of communication deficits. [275] According to decision affect theory, poor performance results in greater disappointment when it falls short of a person's expectations. [276] Halpern and colleagues [275] found people with PD improved on acoustic, perceptual, and communication partner ratings following primary treatment for speech. However, the PD participants in Halpern et al's study did not rate their voices as improved after the intervention. The authors suggested that the education in the treatment resulted in the participants having an enhanced awareness of their voice deficits following intervention, which may have resulted in lower self-rating post, despite improvements in intelligibility. In Loud and Proud, participants received feedback about their speech and voice while practising in group conversations and activities with cognitive-linguistic loading. Tasks in Loud and Proud

were deliberately designed to be more challenging than those in previously reported studies in order to better replicate the naturalistic environment. High-level deficits in lexical retrieval, semantics, syntax, memory and pragmatics were likely to be exposed in these activities, and this in turn may have led to lower ratings of the participants' quality of life and performance in everyday communication.

3.3.2 Dysarthria severity.

In this study, the participants' individual outcomes varied widely. This variability was consistent with previous findings in the PD literature concerning heterogeneity in response to behavioural interventions. [114]

Two of the four participants with mild dysarthria demonstrated an increase in SPL in conversation, while the SPL during the monologue task for three of the four mild participants was increased to a similar degree. However, these improvements in SPL did not result in improvements in perceived intelligibility for any of the participants, nor in communicative effectiveness. The speech intelligibility of mild dysarthric participants prior to the intervention may have created a performance ceiling effect for measures of intelligibility and communicative effectiveness. The duration of the sustained vowel and maximum frequency range remained constant pre- to- post-treatment. Consistent with these findings, the participants with mild dysarthria did not report improvements in quality of life.

Results indicated that two of the five participants with mild to moderate dysarthria improved in SPL and perceptual ratings of intelligibility after completing Loud and Proud; the remaining three participants did not improve on these measures. Participants 1 and 5 were the only participants in the study to be rated as more intelligible after therapy by both raters. This functional change, however, was not supported by any improvement in quality of life for these two participants. Unfortunately, the communication partners of these participants were unavailable to rate communicative effectiveness after the intervention. The change in the duration of the sustained vowel after the intervention was unremarkable for the participants with mild-moderate dysarthria. Two of the five mild-moderate participants had a marginally reduced maximum frequency range after the intervention, while the remaining three participants had comparable range pre- to post-therapy. It is unlikely that the participants with reduced range sacrificed range for loudness, as their SPL measures were similar pre- to post-therapy.

The single participant with moderate dysarthria demonstrated increases in SPL across all tasks. This improved SPL did not translate, however, to improved perceptual

ratings, communicative effectiveness, or quality of communication life. This participant learned English as a second language, and had a strong accent, which may have confounded the perceptual ratings. This participant's improvement in maximum frequency range was within the normal range of variation, [277] and his duration of sustained vowel production was comparable pre- to post-therapy.

The two participants with moderate to severe dysarthria demonstrated negligible change in SPL after therapy. One participant improved in SPL during sustained vowel production by just over 4dB, but there were no other clinically relevant increases. Participants in this group demonstrated the only increase in maximum frequency range that was greater than normal variation over time. Non-communication impaired adults have been reported to have variability of 1 to 4 semitones over time. [278] The moderate-severe participants in the current study increased by 7 and 8 semitones, respectively. The clinical relevance of this change is, however, negligible.

Generalisation of the performance of the severity groups from this study to the PD population is not possible due to the small sample size. This preliminary description does, however, suggest that future research should investigate the effects of dysarthria severity level on response to intervention. Based on this pilot data it would appear that dysarthria severity alone does not account for the variability in response to group therapy, and future research should explore factors such as time since primary intervention, pre-intervention cognitive status, and participant self-efficacy as potential variables associated with treatment response.

3.3.3 Recommended modifications to Loud and Proud.

Several areas for improvement of the Loud and Proud program were identified as a result of this Phase I study. It is suggested that an increase in intensity of intervention is required to improve and maintain vocal loudness in conversational activities. For example, increasing the frequency of sessions over a shorter period of time (for example, eight sessions over four weeks) may be beneficial. To achieve this, the feasibility of delivering Loud and Proud using online technologies should be investigated. Providing the group therapy program via the internet would potentially increase access to treatment and reduce the burden of travel for participants.

Increased practice intensity of the LSVT LOUD® core exercises may also improve the maximum frequency range and duration of sustained vowel production. This could be accomplished by increasing the home practice schedule and adjusting the group session schedule. Loud and Proud encouraged participants to commit to the LSVT LOUD® home

practice schedule in order to create a habit of practice. However, Searl et al. [23] required participants to practise twice a day at home, for a total of 35-40 minutes per day on non-treatment days, and once for 20-30 minutes on the day of the group session. It is suggested that the Loud and Proud home program increase in frequency, and be extended to include the training of reading and daily communication challenges. Participants may also be encouraged to consider the use of assistive technology, such as the LSVT LOUD® Companion™, to facilitate home practice of basic vocal exercises from LSVT LOUD®.

The feedback schedule and methods should also be re-designed for future versions of Loud and Proud. While the treating clinicians were all experienced LSVT LOUD® accredited clinicians, it is possible that without the guidance of instrumental measures, the clinicians were not providing feedback when people with PD were perceptually loud enough to be intelligible, but not within the normal ranges. Different clinicians facilitated each of the four Loud and Proud blocks. Participants may have received different levels of feedback dependent upon their treating clinician. It is recommended that future Loud and Proud programs include brief monologue tasks in the middle of each session, with the SPL measured and feedback provided to the participant.

Some cognitive load tasks in the group therapy program proved unsuitable in the group setting, and did not sufficiently tax cognition. The cognitive load tasks should be refined for the next phase of research into Loud and Proud. For example, the counting task (where multiples of five or seven were replaced by the word "buzz") was too short an activity, and participants adapted to the task over time. This task could potentially be used in addition to another cognitive load activity. Most of the cognitive load tasks were selected (or adapted) to avoid writing, due to the micrographia associated with PD. The exception was the "Consequences" activity. Clinicians reported that the Consequences task was not sufficiently difficult (as it didn't require dual speech and cognitive tasking), that it didn't result in sufficient speech production, and that it was problematic due to the writing involved. It should consequently be removed from future versions of Loud and Proud. The commercially available board games Taboo [279] and Catch Phrase [280] may be appropriate activities to replace the problematic cognitive load tasks. Adding motoric distraction to activities may also be of benefit. Motoric distraction has been shown to result in a deterioration in speech intelligibility in the laboratory, to a level comparable with that collected in samples where the person with PD was unaware they were being recorded. [173] For salience, participants could select their own motoric activity (e.g., knitting), to complete while conversing in the group conversation activities of the final three weeks.

Given the lack of effect of Loud and Proud on quality of life in this study, the program should be amended to focus more on supportive counselling and problem solving for communication participation. To inform changes to the self-management aspects of the program, future research should use qualitative methodologies to investigate the experience of people with PD who complete Loud and Proud, and to explore the influences of behavioural intervention on quality of life. Improved intelligibility and communication effectiveness, along with supportive counselling, may assist in improving the perception of communication quality of life.

3.3.4 Limitations and Clinical Implications.

There were a number of limitations associated with this study. As a Phase I study, [260] this preliminary investigation had a small sample size. Therefore the results are not able to be generalised. Following refinement of the program, larger controlled studies (Phases II, III, and IV) are required to evaluate the outcomes of Loud and Proud group intervention, in order to determine the efficacy of this intervention, and ultimately its effectiveness in the PD population.

The lack of cognitive assessment was a limitation of this study. Loud and Proud included tasks with cognitive distraction, that in particular challenged working memory, a known deficit in PD. [199] Future studies should include a cognitive assessment battery in order to determine the influence of cognition on treatment response.

The factors that influence treatment response should also be defined. Future research should investigate the effects of the baseline severity of dysarthria and the time post-LSVT LOUD® prior to commencing Loud and Proud. [130] There may be an optimal time period following primary intervention during which maintenance intervention should commence. A longitudinal study that follows people with PD from the initiation of primary treatment through to maintenance intervention is recommended to determine the efficacy of Loud and Proud in maintaining the improvement of speech and voice following the LSVT LOUD®. Maintenance intervention should also commence within two years of completing the LSVT LOUD®, during which there is known carry-over of the effects of primary intervention. [122] Including a cognitive-linguistic assessment battery in future studies to establish each participant's level of function on this aspect of communication may provide a greater understanding of the impact of cognition and linguistic impairment on group treatment outcomes. A baseline measure of self-efficacy may also provide information about the influence of participant confidence and self-belief in intervention.

Due to the scope and time limitation of this Phase 1 study, no followup assessments were conducted on these participants. Collection of follow-up data to determine the long-term treatment effects of this treatment program is also required. [22,23,152] It is important to understand how long the treatment effects last, particularly in the context of a progressive disease, and to determine an ongoing maintenance plan. [122,134]

The importance of continued practice (Use It or Lose It/ Use It and Improve It) is established as one of the principles in achieving long-lasting neuroplastic change. [129] Short term intervention is insufficient for lasting change; for maintenance, people with PD should be practising daily, as well as frequently using their loud and effortful speech in the naturalistic environment. As such, research is required to investigate whether group therapy impacts the practice schedules and communication participation of people with PD. [130]

While this study's assessments were completed at the participants' homes to reduce the performance effect of the clinical setting, the participants were aware they were being assessed, which may have influenced their performance. [173] Given that the intention of Loud and Proud is to impact communication in the naturalistic setting, future research should include methodology that involves collection of speech and voice data during normal everyday communication activities in order to mitigate a clinical performance effect.

The outcome measures should also be revised for future research in maintenance of speech following LSVT LOUD®. The QCL is a measure of quality of communication life that is relevant to communication disorders in general, including aphasia, cognitive communication disorders and dysarthria. However, there are some items in the assessment that are less relevant to people with dysarthria than those with aphasia, such as "I follow news, sports, and stories on TV or in movies", and "I have household responsibilities". These items may have negatively impacted on a statistically significant change. Since the commencement of this study, a psychosocial measure specific to dysarthria has been developed (i.e., The Dysarthria Impact Profile) [281] and its use is suggested in future studies. The Dysarthria Impact Profile includes a measure of concern about dysarthria in relation to other worries, which may assist in describing the impact of dysarthria in the context of the person's everyday life. The person with dysarthria also can provide qualitative comments when completing the Dysarthria Impact Profile. [281] Further, qualitative data should be collected from the Loud and Proud workbooks. Collecting this information in future studies may provide further information regarding the participants' self-assessment of conversational competence.

3.3.5 Conclusions

This study has described the speech, communicative effectiveness, and quality of life outcomes of a preliminary Phase I trial investigating the impact of a group therapy maintenance program for people with PD. While the study found statistically significant increases in vocal loudness following the intervention, these changes were not supported by similar improvements in speech intelligibility, communicative effectiveness, or quality of life. Response to treatment was heterogeneous, and the variability was not explained by dysarthria severity. Further research is required to determine factors which may have influenced participant responses to treatment within larger controlled studies, in particular, severity of dysarthria and time since primary intervention. Furthermore, the study provided additional insight into the content and delivery of the treatment protocol which requires amendment prior to ongoing research. Although improving speech outcomes is an important component of a communication management program for people with PD, the impact of group therapy on conversation in the context of a more cognitive-linguistically challenging environment requires further investigation. Chapter Four of this thesis will describe the effects of Loud and Proud on the conversational behaviours of people with PD pre and post this intervention.

4. Conversational Behaviours Before and After Group Therapy in PD: Study II

The communicative abilities and behaviours of people with PD in the naturalistic environment and the impact of intervention on these behaviours have received limited attention in the literature. [144] Research in motor speech disorders has historically focussed on acoustic and physiological characteristics [282] of single speaker productions. However, communicative effectiveness in the natural environment involves two or more participants, both or all of whom contribute to the conversation in progress, and to the process of understanding and responding. [283] Investigation of the conversational abilities of people with PD in their natural context is necessary to determine if outcomes of behavioural interventions result in meaningful change for people with PD in their own environments. [157]

4.1.1 Impact of PD on everyday communication.

Surveys and qualitative interviews have been used to explore the experience of living with communication deficits associated with PD. [30,31,156,234] People with PD have reported that they experience changes to their voice, articulation, and cognitive-linguistic abilities. [30,31,156,234] These changes were confirmed by primary communication partner responses, although the communication partners provided a more positive assessment than did the participants with PD. [30,234] The impact of these changes on everyday conversational ability and social interaction was of concern to people with PD. [31] The communicative changes were reported to cause difficulty with getting into and keeping a place in a conversation. [30,31] People with PD perceived that listeners did not appreciate these difficulties. [31] Listeners were also reported to exacerbate the difficulties by talking over, ignoring or speaking for the person with PD, or treating the person with PD as though they were stupid. [31] Conversely, none of the participants from the study by Antonius, Beukelman [234] reported that conversation partners were "punishing", although only 55% of Antonius et al.'s participants with PD indicated communication partners were "helpful". Conversational difficulties negatively influenced confidence and self-concept, sense of independence, social participation, and family dynamics for people with PD. [30,31,156] Unsurprisingly, some people with PD reported withdrawing from social interactions and conversations. [31,234] Negative changes were reported not only by participants with obvious

dysarthria, but also by people with PD who did not exhibit an apparent decline in intelligibility. [30]

The reported experiences of people with PD are mirrored by the results of studies investigating the perceptions of people with dysarthria resulting from a range of progressive aetiologies (including PD) and stroke. People with dysarthria have reported being conscious of other people's attitudes to their changed speech. [284,285] Listeners were perceived by people with dysarthria to be condescending and to negatively evaluate the person with dysarthria, due to their communication impairment. [284-286] The ability to work, and relationships with spouses and friends were reported to be negatively affected by communication and physical impairments. [285] Feelings of embarrassment, reduced confidence, and inadequacy were reported by the participants with dysarthria. [285] In the community, a number of physical barriers to effective conversation in the everyday environment were identified by people with dysarthria, such as background noise, and glass and Perspex barriers in banks and buses. [285,286] Social withdrawal was common for people with dysarthria following stroke in response to their communication difficulties. [284]

Studies of the experience of living with dysarthria have identified a number of themes that are worthy of further investigation. Further research of the communication partner's role in conversational interactions involving people with dysarthria and the barriers to communication in the natural environment is indicated. Also, investigation of the facilitatory and obstructive influences to conversation involving people with dysarthria has the potential to inform future interventions, such as rehabilitation, communication partner training, and advocacy.

4.1.2 The impact of communication impairment on interaction.

Very mild speech impairments in PD (as measured clinically) have been reported to accompany a strong perception of disruption to interaction. [157] The mismatch between clinicians' perceptual assessment of speech and the self-assessment of people with PD with regards to communication competence suggests that other influences may be affecting conversations involving people with PD. Also, the behaviour of the conversation partners of people with PD in everyday life is relatively unexplored. Qualitative research methods present an opportunity to examine conversations involving people with PD, including the facilitative and obstructive behaviours of both parties. [287]

Everyday conversation involving people with communication disorders has been investigated using a variety of methods such as pragmatic checklists, [176] quantitative surveys of people with communication disorders and their communication partners, [30,176]

and comparison of specific communication behaviours against the findings from studies involving non-impaired populations. [288] A qualitative method for investigating the dynamics of conversation involving people with dysarthria is Conversation Analysis (CA). CA is described as the systematic analysis of conversation, as a representation of human interaction. [289] Conversation is audio- or video-recorded and then transcribed, including details such as prosody, laughter, silence, and simultaneous speech. [182,290] During CA, the researcher avoids assumptions about what the data may reveal [289] as CA is an inductive process. [291] Transcripts of conversations are analysed, turn by turn and conversation by conversation. The analyst seeks distinctive features in an interaction, and then looks for other examples to determine if there is a pattern. [289] Identified patterns are considered within each example or case and across a collection of cases. [182,289] This information is then used to describe the regularities of social interaction. [289] Potentially, CA may provide insight into communication behaviour that is difficult to quantify in experimental design. [282] The inductive nature of CA may reveal patterns of interaction that are not readily predicted.

The nature of interaction in the talk of people with dysarthria has been explored through CA. [182,283,292,293] The way in which people with dysarthria and their communication partners manage problems in "understandability" has been reported in CA studies. [287,294,295] Bloch and Wilkinson [282,294] described how people with dysarthria resulting from motor neuron disease and multiple sclerosis, and their communication partners, managed difficulties in understanding each other. The initiation of repair by the conversation partner illustrated how much of the previous message had been understood. When conversation partners were able to be specific about what had not been understood, and identified single words or prior turns as being difficult to understand, the person with dysarthria was able to reattempt the word or turn. [287,294] The repair process in these instances was relatively simple. [287,294] However, there were examples when neither the person with dysarthria nor the communication partner were certain about what had caused the trouble in understanding the previous talk. [294] Resolving these difficulties was more complex, involved multiple turns, and took significant amounts of time. [287,294] Similarly, the presence of repair attempts that were intelligible and yet not understood were noted in the conversations between people with dysarthria as a result of motor neuron disease who augmented their communication with voice-output communication aids (VOCA) [295]. People with dysarthria have been reported to use oral spelling both to enhance understandability [292] and as a strategy in repair. [283] The importance of the collaborative process between the person with dysarthria and their communication partner in accomplishing understanding was highlighted by the studies above. [287,294,296] People with dysarthria were observed to

break a turn into smaller units (by the use of spelling, or shorter utterances), or to use a VOCA to augment intelligibility. [287,294,295] This was undertaken in order to minimise the risk of complex difficulties in understanding, or as part of the process of repair. [287,292,294,297] In order for these strategies to be effective, it was important for the communication partner to indicate when there was a difficulty in understanding, [294] and to confirm when a message was understood. [287]

Griffiths and colleagues [182] demonstrated the usefulness of CA in examining the conversational behaviours of people with PD and their communication partners. People with PD were observed to overlap (speak simultaneously with) their communication partners. [182] In conversations between participants without communication impairment, gaps between turns average approximately 200ms. [298,299] In order for this rapid transition to take place, the next speaker needs to begin to plan their next turn, having heard only part of what has come before. [298] Griffiths and colleagues [182] suggested the participants with PD may have missed their opportunity to take a turn due to cognitive slowing and slowed motor initiation. The consequence of overlapped speech for the speakers with PD was that their communication partners exhibited difficulty in perceiving and processing the response. [182] Consequently, people with PD and their conversational partners had to work together to correct, or repair, the misunderstanding more often than would be expected in conversations involving typical speakers. [182] For Griffiths et al's cohort, repair was not always initiated when required, and when present, was not always successful. Subsequently, the PD speakers were at greater risk of having their turn "deleted" than were their communication partners. [182] Griffiths et al. suggested that interaction may be enhanced by communication partners being mindful of the impact of overlap in conversations involving people with PD. These illustrative findings demonstrate the value of CA in the investigation of conversational behaviour in PD. To date, exploration of the impact of intervention on the conversational behaviour of people with PD and their communication partners has not occurred. Conversation analysis therefore provides a method for exploring changes in interaction in the everyday environment following intervention.

4.1.3 Methods for describing conversation behaviour.

The utility of CA has been demonstrated in communication disability research. In the speech-language pathology literature, there are also exploratory studies that have compared conversational behaviours across participants, across conversational partners, following intervention, and over time. [288,300-302] Behaviours of the participants within the

conversations, such as repair and contribution of words to the conversation, were identified and frequency counts of the behaviour of interest presented. [300,301,303]

Rutter, [300] in a pilot study of three participants with multiple sclerosis, explored the combined use of qualitative and quantitative measures in describing the conversation of people with dysarthria. Specifically, he proposed the use of quantification in the assessment of repair and speaking time for people with communication disorders. The frequency of repair per minute of speaking time increased with increasing severity of the participants' dysarthria. Repairs by the participant with the mildest dysarthria were mostly self-initiated interruptions, without obvious change to the preceding message. In contrast, the participant with the most severe dysarthria frequently produced repairs that were a modification of a preceding message. [300] In addition to the analyses of repair behaviour, the total talking time for each participant was presented. The participant with the shortest mean interval length (just over one second) and shortest overall total talking time was described as speaking in short bursts, and as having the most severe dysarthria of the group. [300] The qualitative analysis allowed the reader to understand how and why the participants' talking time varied, providing further illustration and confirmation of the quantitatively described communication behaviour.

Another example of quantification of conversational features was provided by the work of Boles [301,303] in his studies of dyads involving a person with aphasia. Contribution of words to conversation, words per utterance, and self-repair behaviour for people with aphasia and their communication partners were reported as counts per minute of speaking time. These measures were compared with standardised testing before and after a seven week course of Conversation Partners Therapy. [304] Following therapy, the participants with aphasia increased their contribution to the conversations and demonstrated a greater proportion of self repair. The communication partners' speaking rate was slower and their repair behaviour and total word count were reduced. [301,303]

Similarly, Ferguson [302] used counts of the features of turn taking and repair to describe the conversations of people with aphasia. Two people with aphasia conversed with each other, an unfamiliar clinician, a lay speaker, and a familiar clinician. For each participant with aphasia, turn taking and repair behaviours were stable across conversational partners and across time. Overlap was a frequent but brief event, consistent with the literature concerning typical speakers. [74,302] The rate of repair for the participants with aphasia was higher than that for the participants without aphasia. Differences were observed among the participants with aphasia in length of turn and number of topics.

Kennedy and colleagues [288,305] applied quantitative analysis to investigate topic setting behaviours between people with right hemisphere disorders (RHD) and their conversational partners. Participants with RHD offered atypical topics during the conversations and initiated new topics when the conversational partner had started to terminate the conversation, which control participants did not. Topic setting, maintenance, and termination skills were also investigated. [305] The ability to manage topic (for example, to introduce, maintain, shade or terminate a topic) did not vary between participants with RHD and those without brain injury. The findings of these studies demonstrate the utility of quantitative counts in illustrating topic setting behaviour in conversation.

While some conversation analysts adhere to qualitative analysis of conversation, [175,306] judicious application of quantification is indicated when comparison is required. [300,307-309] Quantifying characteristics of interest allows exploration of the similarities and differences between people with varying type and severity of communication disorder and the typically ageing population. [300] The use of quantification alongside CA may provide descriptive evidence of conversational change post-treatment. [300,301,303,306,307] The feasibility of quantifying overlap, repair, talking time, and topic setting in the communication disordered population has been established. [288,300,302,303,310] However, in the initial exploration of conversational behaviours, the inductive nature of CA allows for new phenomena to be observed [291] and for problems in interaction to be revealed by participant reaction rather than researcher judgement. [307] As such, CA reveals conversational behaviours of interest, that can then be quantified in order to enable comparison between participants and across time.

Intervention programs seek to improve the communicative effectiveness of participants in their everyday lives. Investigation of the conversational behaviour of people with PD prior to and after intervention is therefore indicated. Thus, this study aimed to examine the conversational behaviours of people with PD before and after group intervention.

4.2 Methods

To examine the nature of conversation behaviour in people with PD, mixed methods were employed. Audio-recorded conversations between PD participants and the researcher before and after the group Loud and Proud program were analysed using CA. Quantitative analyses were completed to further examine the patterns identified through CA. Ethical approval was obtained from The University of Queensland's Medical Research Ethics Committee.

4.2.1 Participants*.* Six participants from the cohort described in Chapter 3 were recruited for this study using stratified purposeful sampling [311] in order to examine a range of dysarthria severity levels. PD speakers with mild (1), mild-moderate (2), moderate (1) and moderate-severe (2) hypokinetic dysarthria were identified. The participants were rated for dysarthria severity as part of the quantitative study, reported in Chapter 3, section 1.1.

The participants in this study were five men and one woman, aged between 60 and 76 years. Participant demographics are presented in Table 7.

Table 7: Participant Demographics

Participant		Gender	Age	Severity	Conv dB Pre Therapy	Conv dB Post Therapy	Years Post PD Dx	Years Post LSVT®	H & Y
4	Joan	Female	76	Mild	61.70	62.17	5	3	1
5	Bill	Male	73	Mild-Mod	61.52	65.32	14	1	2
8	Nick	Male	70	Mild-Mod	64.54	65.28	13	4	2
2	Niels	Male	71	Mod	63.06	68.14	7	3	3
7	John	Male	70	Mod-Sev	59.65	59.85	16	3	4
9	Rob	Male	60	Mod-Sev	56.07	56.6	2	0.5	2

Mod: Severity = Dysarthria Severity; Mod = Moderate; Sev = Severe; Conv dB: SPL in Conversation; Dx: Diagnosis; H & Y: Hoehn and Yahr PD Severity Rating Scale. [261]

4.2.2 Procedure. PD participants were visited at home by the researcher a speech-language pathologist with five years' experience in treating adults with motor speech disorders. Five minute conversations were recorded in the week before and after an eight-week block of group therapy, Loud and Proud. The conversations were primarily dyads between the participants with PD and the researcher, although there were two instances where the PD participant's spouse briefly joined the conversation (in the pre-assessment conversations with John and Nick). The conversations took place at the participants' homes, at a quiet place where the participants felt most comfortable. The data was collected using an Olympus VN-240PC voice recorder situated 40cm from each participant's mouth. According to the methodology, the researcher was instructed to collect a five minute conversation sample at each visit, and was explicitly instructed to converse, as opposed to collecting monologues. A sample time of five minutes was selected to be

sufficient in length to collect commonly occurring conversational features. [312] In total, 63 minutes of conversation were audio-recorded and transcribed.

4.2.2.1 Transcription. All recorded conversations were transcribed verbatim. The initial transcriptions of the recorded five minute conversation samples were completed by a commercial transcription agency, and were limited to a simple orthographic style. Multilayered transcriptions of the conversational samples were then completed by the researcher, who prepared the transcripts according to the Jeffersonian method for conversation analysis. [290] Participant names and locations were changed in the reported extracts, in order to preserve participant confidentiality. Details including emphasis, prosodic changes, laughter and aspiration, and temporal and sequential relationships were transcribed, according to the conventions listed in Appendix B. [175,290,313] The audio files were replayed using PRAAT software, [314] and silences were measured and documented to the nearest tenth of a second, with silences of two milliseconds or less being noted as a micropause. Different fonts were used for the researcher and the PD participants to assist the analysis. Colour coding was used to highlight instances of pauses greater than one second. Figure 11 details the process for data collection and analysis.

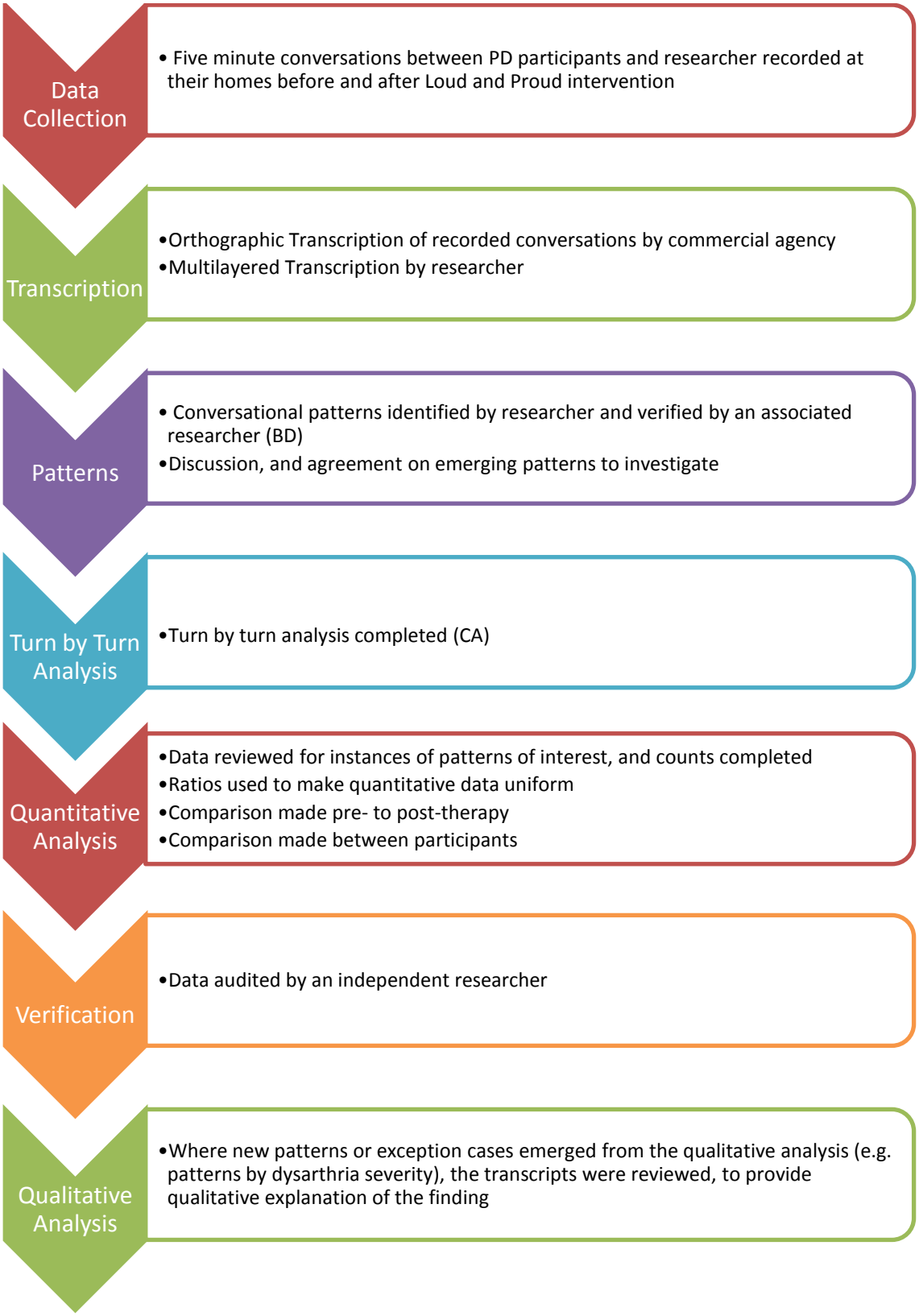


Figure 11. Diagram of the analytic process.

4.2.3 Data analysis.

Conversation Analysis was the primary method of analysis. Descriptive quantitative counts were then completed for conversational behaviours of interest, as identified from

the CA. Transcripts of pre- and post-intervention conversations were analysed turn by turn to explore how the dyad worked together to progress the conversation.

4.2.3.1 Patterns from Conversation Analysis. Analysis of conversations recorded before and after the Loud and Proud program allowed for identification of patterns in the conversational behaviour of the participants with PD and the researcher. Recurring conversation patterns were identified within the data set relating to:

- Topic initiation and contribution to the conversations by participants with PD and the researcher;
- the occurrence and nature of overlapping talk;
- and the dyads' process of repair.

These three key areas will be reported further in section 4.3, as patterns before and after the intervention, and amongst the dyads.

4.2.3.2 Contribution of topic. Instances of talk around a topic were identified by the researcher. The researcher recorded a brief descriptor of each topic, and identified the member of the dyad who introduced the topic, working through the transcribed conversations, turn by turn. The topic, point of topic change, and the initiator of the topic change were subsequently audited by a researcher independent from the study, using the same methods. On disagreement, a decision was reached by consensus. The topics discussed are provided in Table 8, in Section 4.3.1.1.

4.2.3.3 Overlap. Overlap was defined as instances of simultaneous speech by the dyad. All instances of overlapping speech were identified and then classified according to the place of overlap (simultaneous start, mid turn, or last word). Turn by turn analysis was undertaken for representative examples of overlap. Overlap was subsequently classified as competitive or not competitive. [207]

4.2.3.4 Repair. Instances of repair were identified and summarised according to the classification described by Kitzinger [315] The repairs were as self- or other-initiated, and self- or other-executed. The place of repair was also coded. [315] A detailed turn by turn analysis was completed and representative samples of repair by the dyad provided in the findings.

4.2.4 Secondary Analysis.

Following qualitative conversational analysis, counts were made of features of the three emerging conversational features: initiation of topics in the conversation, overlap behaviour, and the process of repair. [300,316] The descriptive statistics were made uniform by calculating ratios, as detailed for each analysis, below.

4.2.4.1 Contribution to the conversation. The percentage of topics initiated by the researcher and the PD participants for each conversation was calculated. The relative number of words contributed by each member of the dyad was also calculated, and made uniform by calculating a speaker's words per minute of sample time. [303] The ratio of words spoken for each sample by PD participants compared with the researcher was also calculated.

4.2.4.2 Repair. The instances of self-initiated and other initiated repair was counted. The repair data were made uniform by calculating the number of repairs made to a speaker's talk for every 100 words he/she spoke in the sample.

4.2.4.3 Overlap. Instances of overlap with competitive behaviours were isolated and described in terms of the decision making tree from Kurtic et al. [207] The percentage of the instances of competitive overlap that was initiated by the participants and the researcher for all dyads was calculated. The speaker that continued with their turn in the event of competitive overlap was also identified, and percentages calculated for the participants and researcher for the cohort.

4.2.4.4 Summary of secondary analyses. In summary, the quantitative analysis included the:

- percentage of the total topics initiated by the participants;
- percentage of competitive overlap initiated by each speaker [207];
- percentage that the researcher and participants continued the turn on competitive overlap;
- ratio of repair type per 100 words spoken per speaker

4.3. Analyses and Findings

Findings from analyses of the five minute conversation samples from the six participants before and after their participation in the Loud and Proud intervention program are reported. Illustrative extracts from the transcripts for each of the key conversational patterns revealed through CA will be presented, and descriptive statistics reported, to illustrate the phenomena amongst dyads and before and after therapy.

4.3.1 Patterns from Conversation Analysis.

As stated in the Methods section, key conversational patterns emerged from inductive CA. Representative extracts from the transcripts will be provided for each of the patterns. Descriptive statistics will also be presented to illustrate the relative frequency of

the conversational behaviours before and after Loud and Proud, and across participants. Extracts and analyses for each pattern will illustrate the following findings, in order:

1. *Increased participant contribution to the conversations after intervention*.

   The conversations recorded before the intervention were largely interview-like in structure. The dominant pattern in the initial conversations was that the researcher asked questions and the participants with PD then responded. In contrast, the conversations recorded post-Loud and Proud contained contributions to the topics of conversation by both the person with PD and the researcher. The participants demonstrated persistence in directing the topic of conversation after the intervention. There were conversational behaviours by the researcher that related to the participants' contribution to the conversations.

   a. *Researcher overlap behaviour*

      The researcher was noted to have initiated overlap less often in the conversations than did the PD participants, particularly after the intervention. In instances of overlapping speech, the researcher was noted to expedite the end of her turn.

   b. *Researcher tolerance of silence.*

      A related conversational pattern was that the researcher exhibited a tolerance for extended periods of silence during the participants' turns when speaking with participants with moderate or moderate-severe dysarthria.

2. *The dyads' processes of repair differed before and after the intervention, and according to dysarthria severity.*

   Two regular conversational behaviours were identified from examples of the dyads' repair in conversation.

   a. *Researcher-initiated repair – before and after therapy.*

      A specific type of repair – candidate understanding – was uniformly initiated by the researcher to verify the talk of the participants, in the conversations prior to Loud and Proud. The researcher offered candidate understanding less often in the conversations after Loud and Proud.

   b. *Impact of dysarthria severity on repair*

      The participants with moderate or moderate-severe dysarthria had episodes of reduced intelligibility that were followed by repair processes. This pattern was not observed in the talk of the dyads involving participants with mild or mild-moderate dysarthria.

4.3.1.1 Participant contribution to the conversations after intervention.

Following the Loud and Proud intervention, four of the six participants were found to exhibit increased contribution to topic setting and maintenance (Joan, Nick, John and Rob). One participant, Niels, demonstrated an increase in persistence in setting the conversational topic, although his relative contribution of topics was similar before and after the intervention. The topics discussed by each dyad are included as Table 8, below. Nick was noted to contribute more topics to progress the conversation in the data taken after Loud and Proud. Joan, John, and Rob were noted to take longer turns, and expand more on topics than before intervention.

Table 8: Topic initiation per dyad

Dyad	PD: Pre	PD: Post	Researcher: Pre	Researcher: Post	Unknown Pre	Unknown Post
Joan	Gaining Weight Work Habits Mentoring/Women at Work *3*	Today's Topic Solar Power "Green" unit block PD Family Environmental Initiatives Attending solar Power *5*	Sun exposure and good skin the researcher's work plans *2*	Australia and alternative power Return to alt power topic *2*	PQI Stones Corner Story *1*	
Nick	Story - Grandson the "electrician" *1*	Nick's grandchildren Moreton Fraser Camping *4*	Son's travel DFO Weekend Grandson's present Nick's family structure *5*	Nick's Children Stradbroke Nick's children travelling up Loud and Proud *4*	Dogs *1*	Twins *1*
Niels	Beer Working at Beer Factory *2*	Father's Wooden Toys Father's crafted cupboards *2*	International Beer Engineering *2*	Christmas Presents Father's Occupation (short) *3*	Wooden Crates *1*	 *0*
Bill	Family moving to be close to Bill Story - working, forced retirement, dx Building home Interior design skill	Driving Trucks CB/Emergency Radio Bill's Brother Return to Bill's brother topic Kindness of people out west	Retiring Coffs Harbour Bill's wife's work	Roadstops What is the purpose of a diff? Emergencies on the road Dogs Topic of conversation Family of truck drivers		

Dyad	PD: Pre	PD: Post	Researcher: Pre	Researcher: Post	Unknown Pre	Unknown Post
	4	*5*	*3*	*6*	*0*	*0*
John	Name of last SP/type of therapy *1*	Starting out in flying Story of flight to Emerald/avoiding food poisoning Story of last flight and problems delivering a plane *3*	Location of rehab Time since last therapy Types of therapy Return to types of therapy topic Story of John getting dog *5*	Frequency of flying *1*	 *0*	 *0*
Rob	Son staying Traffic - causes and examples Owning just one car - benefits the researcher's husband's travel to meet the researcher *4*	Wife's culottes - humorous story Rob's kids' work ethic Teaching too black and white and School not preparing kids for Uni/Work Rob's son PhD Experience with Tertiary Entrance the researcher's High School Humorous story about mutual acquaintance *7*	Road Trip Automatic Cars the researcher's husband's motorbike Rob's Nissan *4*	Rob's son and study *1*	 *0*	Snake *1*

Extracts from the transcripts provided evidence of persistence in competition for the turn and increased turn length by the participants, in the conversations after Loud and Proud. Extracts 1 to 3 highlighted the occurrence of overlapping speech by participants when topic setting. Extract 4 and 5 illustrated an increase in turn length after the intervention.

Extract 1

Extract 1 was taken from the conversation between the researcher and Rob, after Loud and Proud. Prior to this segment of conversation, the researcher had been recounting a story about her brother-in-law Phil, and his subject choice at school.

Extract 1: Rob (moderate-severe dysarthria, post intervention)

1	**AE:**	**[yeah,] (.) yeah. and yeah, I was probably**
2		**fortunate (0.7) cause I went to school, um, (.) ((*f*)) and I went to adelaide high¿**
3	Rob:	mmm.
4	**AE:**	**°hh I think um (0.6) yeah, ((*f*)) well, I did (.)**
5		**the same thing [as p h i l.]** ←
6	Rob:	([so liam rayner li]am) rayner would have. ←
7	(0.5)	
8	**AE:**	**↑yeah that's right, liam r[ayner was the prin- ↓deputy there]=**
9	Rob:	[yeah yeah yeah]
10	**AE:**	**=at the ((creaky)) time.**

The researcher extended the topic at line 1, to introduce her own schooling experience. Rob overlapped at line 6 to introduce a humorous story about a mutual acquaintance from the researcher's school. The overlap was at a syntactic boundary, which was a logical ending point for the researcher's turn. Rob repeated (or recycled) the words in this turn, which marked the competitive nature of the overlap. The topic change was successful, and Rob consequently contributed his story.

The researcher's behaviour on overlap was also of note. At line 4, the researcher's voice became louder, as she introduced a new anecdote to the topic under discussion. However, at line 5, when overlapped by Rob, the researcher stopped talking, and ended with a falling intonation, signalling the end of her turn. This was despite her anecdote being

unfinished. At line 8, the researcher acknowledged the shift of the conversation to the new topic, and Rob subsequently told his story about the mutual acquaintance.

Extract 2

Extract 2 illustrated the use of overlap to enable contribution to the conversation. The conversation took place in the post-intervention conversation, just before Christmas. The researcher and Niels were discussing the presents under his tree, and segued to a discussion about gift-giving.

Extract 2: Niels (moderate dysarthria, post intervention)

1	**AE:**	**=so we just do it for the im[med]iate family-[which] makes it so much easier,**
2	Niels:	[yes] [y e s.]
3	**(.)**	
4	Niels:	that's a good (.) good idea, °h[hhhh]
5	**AE:**	**[yeah,]=**
6	**AE:**	**=when you've got [little o]nes though >[they need to] °get presents¿<°=** ←
7	Niels:	[when:] [when I] ←
8	Niels:	=yeah. °hh (.) the kids nowadays they ha:ve °hhh too: much. (.) °hh and (.) (I – I
9		– I re-remem) (.) I remember when °hh I was a kid °hhh (0.4) my:: d-d-dad he
10		was a, (0.5) a (furniture) maker

In line 4, the syntax of Niels's utterance was complete and correct at "good idea", and the researcher commenced her turn. However Niels's audible inspiration, and the continuing intonation of "idea", indicated that his turn was not complete. A competitive overlap (indicated by Niels's recycling of words) was subsequently instigated in line 7. When Niels made his second attempt to start his turn in line 7, the researcher's speech became accelerated and softer, which expedited the completion of her turn. There was no discernible pause following the researcher's turn. Niels commenced his utterance immediately after the researcher stopped speaking (known as latching). The commencement of Niels's turn at line 8 marked the introduction of a new topic: Niels's childhood experiences of receiving his father's home-crafted toys for Christmas.

In this extract, the researcher gained the floor from Niels during a pause in his turn. Niels demonstrated persistence in regaining the right to speak, and successfully used

overlap to achieve a change to his preferred topic. In response, the researcher conceded the turn.

Extract 3

Increased persistence in setting and maintaining topics of their choice was also seen in the conversations with less severely dysarthric participants. Joan was the least severely dysarthric participant in the cohort. Although her volume was reduced, her speech was intelligible in the quiet environment in which the samples were taken, and her prosody was intact. Extract 10 illustrated Joan's persistence in redirecting the conversation to her chosen topic. This extract was taken from the second conversation with Joan, after the group therapy. Leading to this, Joan had been recounting the story of her family's efforts to conserve water and use solar electricity. The researcher's contribution to the conversation to this point had predominantly been encouragement and questions about the equipment.

Extract 3: Joan (mild dysarthria, post intervention)

1	**AE:**	**ah because I think more and more people (0.4) electricity will rise¿ =**
2	Joan:	=yes=
3	**AE:**	**=ah in the next [two years. >it's got to happen<]**
4	Joan:	[well::, w e l l] it's going to rise next year. ←
5		(.)

6 **AE:** **oh- and it- it just has to.**
7 Joan: yes.
8 **AE:** **we can't keep,**
9 **(0.3)**
10 Joan: and, ah, =
11 **AE:** **=°burning through coal the [way-]**
12 Joan: [my] brother (0.7) rang me um (0.6) the other day
13 and he-, in the course of conversation, he said °hhh that a man was coming to talk t:o
14 a grou:p of them. [he li]ves out near Brighton
15 **AE:** **[°mm°]**
16 **(0.9)**
17 Joan: and, um, (0.3) I think I told you this yesterday.
18 **AE:** **°^yep.**
19 Joan: So he an- (0.3) he had (.) a group of local people come to his place and he asked us if
20 we'd like to [go]
21 **AE:** **[^m↓m]**
22 Joan: °hhh and (0.7) ten out of (.) eleven people who ca:me (0.3) booked up for it.

After an extended period of listening and encouraging, the researcher contributed a shift in topic, broadening the conversation from Joan's family's environmental initiatives, to the national perspective. The attempt was not fluent, and the researcher repaired by restarting and restructuring her statement. Joan first overlapped at line 4, adding to the researcher talk about power rises with confirmation that the rises were happening happening. When overlapped, the researcher compressed her speech, which expedited the end of her turn at line 3. The researcher acknowledged Joan's contribution in line 6. Despite the incomplete syntax of the researcher's statement in line 8 ("we can't keep"), and the presence of continuing intonation during the word "keep", Joan commenced her turn after a 0.3 second pause. The researcher latched her next utterance to Joan's mid turn, with reduced volume. Joan again overlapped at line 12, in the middle of the researcher's turn, and stressed the first two syllables of her turn. The researcher stopped speaking with a clear cut-off in line 11, and did not continue attempts to progress the topic shift.

Extracts 1, 2 and 3 provided evidence of the participants' increased persistence in contributing to topic setting in the conversations after Loud and Proud. The participants used overlap to gain or regain a turn, to direct the conversation to their preferred topics.

Also demonstrated were the researcher's conversational behaviours that signalled the relinquishment of her turn on overlap by the participants.

Extracts 4 and 5 illustrated an additional pattern related to contribution to topic following Loud and Proud. Joan and John increased the length of their turns after the intervention. Extract 4 was a segment of speech typical of the pre-intervention conversation involving John. His turns were short, and the researcher directed the conversation. Extract 5 was a representative sample from the conversation after the intervention. John's turn length greatly increased in the conversation after Loud and Proud.

Extract 4

In the conversation with John, recorded before treatment, it was the researcher who initiated and set the topics of conversation. In the conversation recorded after the group treatment, John set all of the topics in the conversation, and this was accompanied by extended periods of monologue. Extract 4 was taken from the conversation involving John, before Loud and Proud, and illustrated the nature of the pre-treatment conversation sample with John, which was similar to a clinical interview in nature. John's wife, Sal, was in the room, completing a questionnaire for the researcher and participated in this part of the conversation.

Extract 4: John (moderate-severe dysarthria, pre-intervention)

1	**AE:**	**so ↑when a- (.) ↓were you last at stafford¿ rehab.**
2	**(2.4)**	
3	John:	I don't understa::nd=
4	**AE:**	**=or: geebung /wihæb/. >did you go to °w-< (0.8)** ←
5		**[stafford] or [geebung]?**
6	John:	[no,] [staff-] s::tafford.=
7	**AE:**	**=sta:fford. yep¿** ←
8	**(0.8)**	
9	John:	ah:: [::]
10	*Sal:*	*[we] only went once to geebung. didn't we?*
11	(0.4)	
12	John:	yeah:: [: .]
13	*Sal:*	*[an]d that was st um*

14	(0.4)	
15	John:	((louder)) that ((end loud)) was ((dim)) (just at the end of the year)
16	(0.2)	
17	*Sal:*	*mm?*
18	(0.5)	
19	John:	I mean that was just at the s::or- at the end of the year. =
20	*Sal:*	*= mm.*
21	(0.5)	
22	**AE:**	**so for your review.**
23	John:	((voice creaks)) ::::ah ((louder)) I forget °°ah °° [I'm sorr]y, =
24	**AE:**	**[mm mm.]** ←
25	(0.4)	
26	**AE:**	**so it's been? a while.**
27	John:	°hh hh it's been at least two year::s. =
28	**AE:**	**= °yeah, yeah oh, that's good. it's a good time for us to be picking up, with** ←
29		**you n[ow:] .**
30	John:	[°mm].

John's turns in this extract were short, and were responses to the researcher's questions and statements. The researcher leaves no gap between the end of John's turn and her confirmation of previous talk at lines 4, 7, and 28, and overlaps John's turns with confirmation at line 24.

Extract 5

In contrast, Extract 5 illustrates John's ability to contribute and maintain a preferred topic after Loud and Proud. The sequence was taken from the conversation after the intervention, during which the topics were all set by John. The topics were about John's area of keen interest, flying.

Extract 5: John (moderate-severe dysarthria, post-intervention)

1	John:	=yeah:: too righ::t. (0.7) all my contacts were in darwi::n (1.6) and um::, =
2	**AE:**	**=no where to fly to.**
3		(1.6)

4	John:	yeah. (1.4) (and later I) moved from and (later later I moved to) I got moved
5		from, (1.0) or I got transfer::red from (1.4) mackay down to rockhampton (2.0)
6		and u:m, (5.8) u:m, (2.6) (didn't get much chance) to fly th:ere (1.4) but ah::, (.)
7		I met a (couple of guys) in mackay, one. (.) ((*accel*)) (who was the brother of)
8		((end *accel*)) Bob John::son (1.6) and he: turned out to be a bit of a spokesman for
9		the industry. (1.6) an:d um::, (then we flew) out to ba : maga: and um, (2.0) I
10		know there's one thing (.) I recall that, (1.4) (when we stopped off,) (.) to go to:
11		we got a pie for lunch, (1.1) (°and he:: said°) (1.6) you having, pies or a sausage
12		roll or um (1.5) or um ham and salad rolls, and I said no:, I'll only have the pie::
13		. (0.7) (yeah >right away< he said I'll have the ham and salad ro::ll:) (0.8) he said
14		he said if the pie :: makes both ((dim)) of us crook ((end dim)) one of us (1.1) has
15		to be able to fly.

John's turns were long and monologue like in nature. Of note is the extended length of pauses in John's speech after the intervention (up to 5.8 seconds in line 6), which remained unfilled by the researcher. This tolerance of silence by the researcher will be discussed in more detail, in the next section.

4.3.1.2.1 Participant turn length and researcher's tolerance of silence. The researcher demonstrated a related conversational behaviour when conversing with the most dysarthric participants. In two dyads, the researcher tolerated extended periods of silence during the participant's turn without attempting to progress the conversation. The participants in these conversations had moderate or moderate-severe dysarthria (Niels and John, respectively). The researcher tolerated silence before and after the intervention when speaking with Niels, but only in the conversation after the intervention for John. Extracts 6 and 7 were taken from the conversations involving Niels (pre) and John (post) and illustrated this phenomenon.

However, the researcher's tolerance of silence was not uniform across the dyads, and not uniform across the moderately-severe participants. The researcher did not demonstrate the same tolerance for silence in the other conversations, including the conversations with Rob, the remaining speaker with moderate-severe dysarthria. Extracts 8 and 9 provide representative examples of the researcher's conversations with Bill (mild-moderate) and Rob (moderate-severe), during which the researcher spoke on silence, to progress the conversation.

Extract 6

Extract 6 provides illustration of extended pauses during a participant's turn. The extract was taken from the conversation with John after the intervention, during which all topics were set by the participant. Leading to this conversation, John had just finished an anecdote about a pilot acquaintance who ensured that each person had a different lunch, to ensure that food poisoning wouldn't incapacitate both pilots.

Extract 6: John (moderate-severe dysarthria, post-intervention)

1	John:	[(and we got] home) (1.5) but just about the only good thing it was a) twin engine
2		aeroplane, (0.7) a big cessna four oh f:our, (1.2) and it was twice the size of anything
3		I'd ever fl::own.
4	**AE:**	**((laughter)) and ↑h(h)e's go(h)ing to l(h)et you**
5		**l[o(hh)ose to fl(hh)y it. ((laugh]ter))**
6	John:	[((l a u g h t e r))]
7	**AE:**	**↓bet you were hoping he wasn't gettin crook¿ ((laug [h t e] r)).**
8	John:	[yeah:: .]
9		(.)
10	John:	I could hear this guy, that flew all the way to adelaide, (0.9) °hh and arrived in
11		(°certain°) places. (1.7) and um: , (3.9) in the last trip I did¿ (1.2) one of those two
12		(while hired) down in the south australia,
13		(0.3)
14	**AE:**	**°mm¿**
15		(0.5)
16	John:	a::nd so:: delivering a brand new aeroplane, (1.3) to this grazier, (1.6) bill harold up at
17		(old marrow) town. (1.4) >anyway we (0.9) went from sydney to, I flew from sydney
18		to:, (1.7) albury, (1.5) and um :, (1.7) billy who was the:: (0.4) °my old mate who was
19		the::, ° (0.3) regional manager of crews aviation, (1.7) next morning he flew from (2.0)
20		((very slurred)) and I was in the ((end slurred)) we swapped seats, (0.5) I left the front
21		seat (1.0) and ah, (0.9) I >got moved to the< ba:ck and Billy and donna said >dyou
22		mind if I go to the< right front seat¿ (1.1) lot of contortion >but in the end we made
23		it,<
24		(0.3)
25	**AE:**	**↑m(hh)m.**
26		(0.4)

Extended periods of silence were conspicuous during John's monologue-like turns in this extract. At line 1, John describes the aeroplane as being much bigger than the aeroplanes he had previously piloted. The researcher's response at line 4 was an appreciation of the ramifications of John's talk. She laughed as she stated "and he's going to let you loose to fly it". John joined in the laughter, at line 6, and researcher added "bet you were hoping he wasn't getting crook (ill)". Following this appreciation, John commenced another anecdote about flying, from lines 10-23. John's turns were long and monologue like in nature. There were lengthy, unfilled pauses, which are highlighted in red. Questions and verbal encouragement from the researcher were infrequent.

Extract 7

Extract 7 provides an additional example of the researcher's tolerance of silence. This example was taken from a conversation involving Niels, who had moderate dysarthria, from data collected prior to the Loud and Proud intervention. Leading to this example, the researcher had asked Niels whether he had enjoyed working as an engineer. Niels confirmed that he had enjoyed his work, and this extract commenced as he began describing the progression of his career, following his blacksmith's apprenticeship.

Extract 7: Niels (moderate dysarthria, pre-intervention)

1	Niels:	=and then I (1.6) majored as ships engineers (.) °hh (0.9) (the occasion) °hhh and then
2		I (0.3) went to (1.0) university and °hhh got a (.) engineering degree (0.5) °hhhh and
3		then I worked for (0.9) a::: (1.0) ship yard (1.2) short time and then (0.5) for (0.5) bang
4		and olufsen (.) radio factory,
5	(.)	
6	**AE:**	**mmm.**
7	Niels:	and then: (.) later on (.) °hh for :ah furniture (0.65) °hh company where I was
8		working. (.) twent-ty(.) two years °hhh (0.3) it was ah in (.) worked for joyce and
9		company (3.6) and ah (1.8) in that job (.) I wa:s: travelling a lot, °hhh
10	**AE:**	**mmm:=**
11	Niels:	=for troubleshooting and (0.4) commissioning of °hhh (1.9) plans.
12	**AE:**	**°yeah:°**

As per the previous extract, there were multiple instances of extended silence during Niels's turn (pauses greater than 1.5 seconds were circled). Verbal encouragement from

the researcher was infrequent, with the researcher indicating "mmm" after continuing intonation or "yeah" after the falling intonation at the end of Niels's turn in line 11.

Extract 8

Silence was not as prominent in the conversations involving participants with mild or mild-moderate dysarthria. Extract 8 demonstrated the researcher's tendency to offer verbal encouragement following silence when conversing with the less severely dysarthric participants. Extract 8 was taken from the pre-intervention conversation, when Bill and the researcher were discussing his retirement from work. Bill's speech was characterised by a mild-moderate reduction in intelligibility.

Extract 8: Bill (mild-moderate dysarthria, pre-intervention)

1	Bill:	so well ¿ hh (1.2) that's what he: did: (0.8)°hh=
2		=[ah I pulled the pin] yeah yeah=
3	**AE:**	**[°(retired early)]**
4	Bill:	=but I worked at boral for ten years, eleven years and had three shi- °hhh three sicks
5		days (.) >THree (.) SIck (.) Days< in (.) ten ye:ars.
6	**AE:**	**yeah¿ in spite of the trouble that was star[ting for you]**
7	Bill:	[yeah. yeah] an then °hh (0.3) hh that
8		BOral wanted >°sss- to: ah ah< get their doctor to assess me and I said, ↓no::, I'm not,
9		(0.5) [I-]
10	**AE:**	**so [they were trying very hard to keep you.**
11	Bill:	yeah. °yeah. yeah.
12	**AE:**	**ye[a h .]**
13	Bill:	[I said], °no no° I'm finished °so° (0.4) °hhh
14	**AE:**	**°ye[:ah.]**
15	Bill:	[(°they) put me under pressure ° (0.8)
16	**AE:**	**a[n-]**
17	Bill:	[there] were not that there >was that< much pressure but (.) °hhhh I thought sh::tr
18		oh:: . I was sixty six
19	(0.3)	
20	**AE:**	**((breathy)) °yeah°** =
21	Bill:	=it's time to give it away so
22	(0.7)	
23	**AE:**	**yeah=**

The researcher assisted with wordfinding (line 3), filled pauses with encouragement (for example, lines 12, 14, 20 and 23), and requested confirmation of an interpretation (lines 6 and 10). The majority of pauses in this example were ended by the researcher speaking, and the longest pause in the segment of talk was the 1.2 second pause during Bill's turn in line 1.

Extract 9

The researcher's tolerance of silence in the conversations was not a universal finding for the dyads involving participants with moderately-severe dysarthria. Extract 9 was taken from the conversation involving Rob (who had moderate-severe dysarthria), after the Loud and Proud intervention. Prior to this extract, Rob and the researcher had been discussing his children's academic abilities and tertiary entrance results.

Extract 9: Rob (moderate-severe dysarthria, post-intervention)

1	Rob:	[so] I know well anyhow that's fine. (1.0) but chris<u></u>topher he, um, didn't get
2		his one, (0.4) he got a two. (.) °hh and he said dad, ^how on earth did I ^get a two?
3		↓he said if I got ninety eight percent? for everything. I said oh (0.9) you averaged
4		ninety eight per[cent and-]
5	**AE:**	→ **[depends] on how much you beat people By**
6		**[and how] smart the people you beat are. ((la[ughs))]**
7	Rob:	[and how] [yeah.] how smart the people you beat
8		are.
9	**AE:**	**yeah. °h=**
10	Rob:	=he said I've beaten all of them. I said you've got to beat them by More.
11	(0.2)	
12	**AE:**	**[ye(hh)ah.] th(hh)at's e[xa(hh)ctly] ri(hh)ght. ((laughs)) °HH**
13	Rob:	[y e a eah.] (0.6) [ye(hh)ah(hh)] [yeah]
14	**AE:**	**[my,] and my**
15		**brother-in-law was exactly the same because of the [subjects he took.]** ←
16	Rob:	[and um yeah]

17	**AE:**	**he's a - he's an exTremely Bright man.**
18	Rob:	yeah,=
19	**AE:**	**=but he took, u::m::. history an::[:d]**
20	Rob:	[oh]: ((dim)) and geography an:::d
21	**(0.2)**	
22	**AE:**	**and (.) you know, [those so]rts of thing:s,=**
23	Rob:	[yeah.]

In line 5, the researcher overlapped in the middle of Rob's turn, to complete Rob's statement. At line 9, the researcher's turn ends with an audible inspiration, after which Rob latches his next utterance. At line 14, the researcher commenced a story about her brother-in-law's experience of the tertiary entrance system. Rob overlapped at line 16 – his turn commenced with "and" followed by a dysfluency, however, the turn was abandoned after "yeah". At line 16, the researcher does not relinquish her turn when overlapped by Rob. This extract showed the researcher competing for the turn, rather than waiting for the participant's contribution.

These four extracts illustrated the researcher's variable tolerance of silence. Tolerance of silence was only present in conversations with speakers with moderate or moderate-severe dysarthria. For John, the researcher demonstrated tolerance of silence only in the conversation after the intervention, a pattern that co-occurred with John's increase in turn length and control of the topic of conversation. The conversations with Rob were an exception to this pattern across severity. Unlike the findings related to the other participants with moderate or moderate-severe dysarthria, silence was not a feature of the conversations involving Rob. Instead, conversation with Rob featured high researcher and participant incidences of overlap.

It was apparent from the qualitative analyses that the participants increased in topic setting activity after the intervention. The researcher demonstrated behaviours that facilitated this increase, in particular, relinquishing the turn on overlap, and tolerating silence during participants' turns. Descriptive statistics were calculated to explore the frequency of topic setting initiation before and after intervention, and amongst dyads. The asymmetry between the researcher and participants' use of competitive behaviour for the turn was also examined by quantification of instances of competitive overlap behaviour. The participants increased in the percentage of topics they contributed to the conversations, following the intervention. With regards to the use of competitive overlap, the participants initiated a greater proportion of competitive instances of overlap than the

researcher, and were more likely to continue their turn in the presence of overlap with competitive features.

4.3.1.1.1 Descriptive statistics: Topic. Figure 12 presents the percentage of topics contributed by the participants to the conversations before and after therapy.

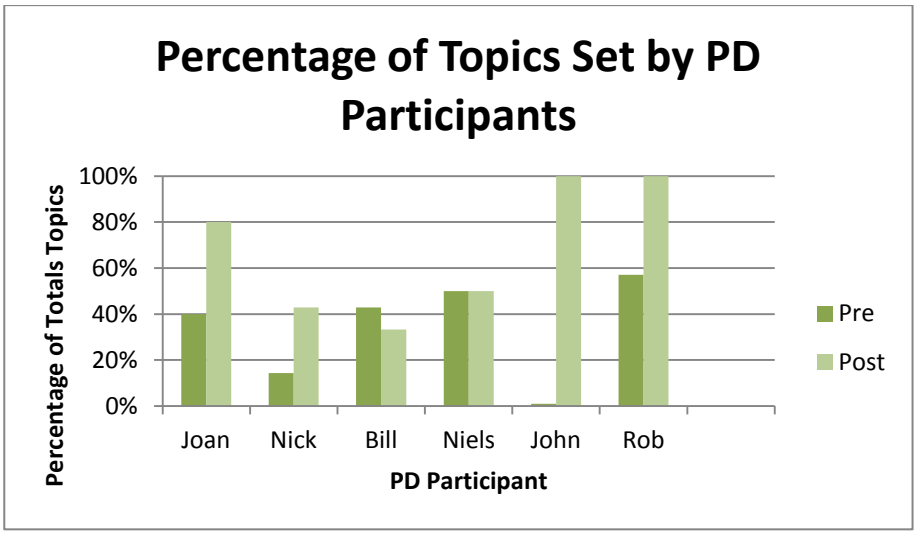


Figure 12: Percentage of total topics set by participants

Before the Loud and Proud Intervention, the researcher offered more than half of the topics in the conversations with Joan, Nick, Bill, and John. The dominance of the researcher in topic setting reflected the interview-like nature of the conversations. After the intervention, Joan, Nick, John and Rob offered more topics in their conversations than they did before the conversations. Niels had similar levels of topic setting behaviour before and after intervention and the percentage of topics contributed by Bill decreased slightly. The quantitative findings confirmed the qualitative finding of increased topic setting behaviour by participants in the conversational data collected after Loud and Proud.

4.3.1.1.2 Descriptive statistics – overlap behaviours. The qualitative analysis revealed asymmetry between the researcher's persistence in gaining and keeping her turn, and that of the participants. This asymmetry was explored further through calculation of descriptive statistics. Overlap was chosen as the feature of choice to quantify. This data was further refined to investigate the occurrence of overlap with competitive features. The instances of overlap with characteristic competitive behaviours are presented in Table 10.

Table 10: Initiation and Turn Completion in Competitive Overlap.

	Participant	Total Comp	Participant Initiated	Researcher Initiated	Participant continued turn	Researcher continued turn	Both completed turn
Pre	Joan	8	7	1	4	2	2
	Nick	1	1	0	1	0	0
	Bill	3	3	0	2	1	0
	Niels	2	1	1	2	0	0
	John	3	3	0	1	0	2
	Rob	10	3	7	3	7	0
	Total	*27*	*18*	*9*	*13*	*10*	*4*
	Percentage of total comp		66.67%	33.33%	48.15%	37.04%	14.81%
Post	Joan	4	4	0	2	1	1
	Nick	8	7	1	4	2	2
	Bill	7	5	2	6	0	1
	Niels	3	3	0	1	2	0
	John	0	0	0	0	0	0
	Rob	11	8	3	5	6	0
	Total	*33*	*27*	*6*	*18*	*11*	*4*
	Percentage of total comp		81.82%	18.18%	54.55%	33.33%	12.12%

Note. Both = Researcher and Participant. Comp = Competitive overlap behaviour

The participants with PD were more likely than the researcher to initiate a competitive overlap, initiating greater than 50% of competitive overlap instances before and after therapy. Participants were also more likely than the researcher to persist with their turn during overlap. The conversation before therapy with Rob was the exception to this pattern; the researcher was more likely than Rob to initiate competitive overlap prior to therapy, and to persist in continuing the turn. The ratio of competitiveness slightly increased in favour of the PD participants after therapy, as a result of Nick and Rob's increases in competitive overlap. Joan and John demonstrated a reduction in competitive overlap post-therapy, consistent with the monologue nature of their turns in conversation post-intervention.

Descriptive statistics of topic, overlap and competitive behaviour confirm the findings of the qualitative analyses:

- participants contributed a greater proportion of topics to the conversations after Loud and Proud;
- overlap behaviour of the researcher was different from that of the participants;
- the researcher was less likely to use overlap competitively than the participants;
- the researcher was less likely to continue her turn on competitive overlap.

Also, the descriptive statistics highlighted the exception case amongst the data. Before therapy, overlap within the dyads steadily decreased with the severity of the participants' dysarthria, with the exception of the dyad involving Rob. Likewise, before therapy, the Rob was the only participant more likely to be competitively overlapped by the researcher. This was consistent with the qualitative finding that the researcher was less likely to tolerate silence when conversing with Rob, than she was with other participants with moderate or moderate-severe dysarthria. The interaction between Rob and the researcher will be considered further in the Discussion (Section 4.4).

4.3.1.2 Repair. There were two conversational behaviours of note relating to repair in the data set. The first was a difference in researcher-initiated repair behaviour in the conversations before and after Loud and Proud. Prior to Loud and Proud, a frequently occurring format for participants' other-initiated self-repair was the researcher commencing repair by way of a "candidate understanding". [315]

The second finding relating to repair behaviour was related to the effect of intelligibility on repair behaviour. The dyads involving participants with moderate and moderate-severe dysarthria undertook repair processes that stemmed from the participants' reduced intelligibility. This pattern was not present in the conversations involving the less affected dysarthric speakers.

4.3.1.2.2 Other-initiated repair before and after therapy.

A candidate understanding is an interpretation offered by the listener of their understanding of the previous talk for confirmation. [315,317] The researcher was noted to give an interpretation of preceding speech, for verification or correction by the person with PD. This pattern was sometimes, but not always, related to issues with intelligibility. Candidate understanding by the researcher was present in the conversations of all dyads. In the data set for this study, the researcher was noted to offer a candidate understanding more often in the conversations before group therapy than afterwards. Two extracts will be presented from the pre-therapy conversations involving Nick and Niels to illustrate the use of candidate understanding.

Extract 10

Extract 10 illustrates the use of candidate understanding by the researcher. The extract was taken from the pre-intervention conversation with Nick, a participant with a mild-moderate reduction in intelligibility as a result of his PD. Nick's speech was mostly intelligible with occasional dysfluency, and his voice was mildly reduced in SPL. In this extract, Nick was telling a story about his grandson's pretend participation in electrical work that was being undertaken outside.

Extract 10: Nick (mild-moderate dysarthria, pre-intervention)

1	Nick:	well the other d:ay um: . (0.4) the electricity department was changing the
2		wires ((strained)) at - at ((end strained)) (.) my daughter's ho:me at dee why, (.)
3		we were [over] there: visiting, (0.5) °hhh and, ah, (1.6) the- the l:inesman got=
4	**AE:**	**[yes]**
5	Nick:	=up the po ::le (0.3) to change the wire: and he's shouting instructions to his- (.)
6		his (.) friends on the floor:, you know, lift me this, give me that °hh and henry's
7		saying Yes yes, okay.
8	**AE:**	**°°°oh (hh) : (hh) :[(hh)]**
9	Nick:	[now] where's the hammer. Yes, Yes, here's the hammer.
10	**AE:**	**↑oh, so he's actually helping him [giving the tools.]** ←
11	Nick:	[oh - oh well from the ver]a:ndah he
12		was. [you know,]
13	**AE:**	**[↑yeah yeah.] oh::::, s:::[o::: cute.]**
14	Nick:	[cause the ver]anda's quite high, it made
15		him, (0.2) pretty well on the level, with the guy: .

In line 10, the researcher offered a candidate understanding. At the beginning of the turn, the researcher acknowledged the story with "oh". She subsequently offered an interpretation of the story for Nick to verify, that the child was physically giving the electrician his tools. Nick's statement at line 11 ("well from the verandah he was, you know") eliminated the possibility that his anecdote was about the child physically offering a hammer. To execute the repair, Nick overlapped at the first possible place that the researcher's turn could be taken as complete (a transition-relevance place).

Extract 11

Extract 11 provided another illustration of the researcher's use of candidate understanding to initiate repair. This extract is taken from the conversation prior to the intervention between Niels and the researcher. In this extract, Niels was recounting the story of consulting to a beer factory.

Extract 11: Niels (moderate dysarthria, pre-intervention)

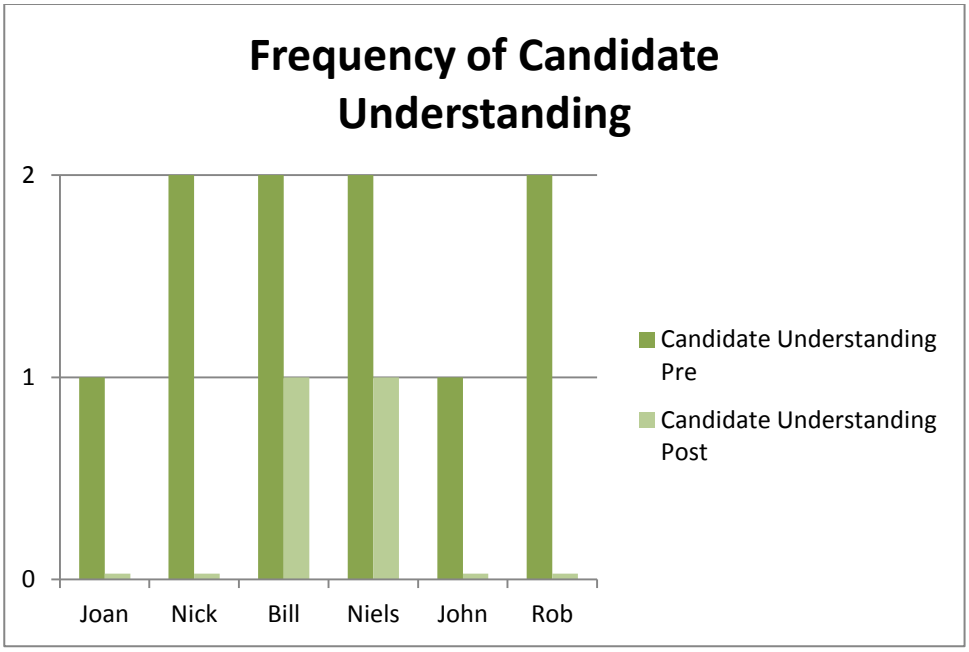
1	Niels:	>yeah yeah yeah< a: (.) the company I worked for :::used to supply some °hhh
2		compressors to the beer factory (0.6) °hh (.) and (you had to)-to install them (.) °hh
3		and to (.) commission them, (0.6) ((click)) (0.3) I went over there a few times, (0.5) °hh
4		(0.6) and ah (0.8) ((click)) (1.0) they had a (.) a system where (0.9) when you were
5		working (there), (0.3) you could drink whatever you want to drink, (0.3) °hhh a beer
6		or soft drinks or °hhh anything (.) °hhh but if whoever was (drunk) (.) when you
7		went through the gate, (0.5) °hhh you would be paying for (.) coming there again.
8		**(0.5)**
9	**RA:**	**oh:::: . (laughter) so you had to (.) sleep it off before you: [laughter]**
10		**[le(hh)ft the(hh)] (.) ga(hh)tes.**
11	Niels:	[oh yeah, yeah.]
12	Niels:	yeah, you couldn't drink >too much, there.
13	**RA:**	**yeah. that's smart. that's a good way of doing it, actually.**
14	Niels:	yeah.

At line 9, the researcher offered an interpretation of her understanding of the anecdote, that employees could drink so long as they were sober when they left. Again, Niels's use of "oh" at line 11 indicated that he had new knowledge after the researcher's turn about her understanding of his talk. [318] At line 12, he rejected the researcher's summary of his previous talk, stating that "you couldn't drink too much there". It was ambiguous from the researcher's response at 13 whether the researcher correctly decoded the intended meaning after the repair.

In offering candidate understanding, the researcher was making claim to have receipted the intended messages in these instances, subject to verification from the participant with PD. [315] However, the subsequent elaboration in responses by the participants with PD revealed this was not the case. In the entire data set, only two examples of candidate understanding from the pre-therapy instances were confirmed as

being correct. In all instances, a particular trouble in understanding was addressed by the researcher's initiation of repair.

The use of candidate understanding was present across participants of all severity levels in the pre-intervention conversations, although the number of instances was small. After intervention, the researcher's use of candidate understanding in repair decreased. Figure 13 presents the occasions during which the researcher offered candidate understanding before and after Loud and Proud. There were 10 instances of the researcher using candidate understanding in the conversations prior to therapy, and two instances in the data collected after therapy.



` *Figure 13. The researcher candidate understanding counts across participants*

Candidate understanding was the predominant researcher-initiated repair pattern for troubles relating to the participants' talk. Table 9 includes the rate of self- and other-initiated repair of the participants' talk, for every 100 words spoken by the participant.

Table 9: Repair type before and after therapy, standardised per 100 words.

Dyad	Self Initiated		Other Initiated	
	Pre	Post	Pre	Post
Joan	0.82	1.71	0.27	0.14
Nick	0.60	1.65	0.20	0.00
Bill	2.77	1.57	0.23	0.36
Niels	0.43	1.70	1.29	0.00
John	1.79	1.83	0.30	0.00
Rob	1.34	0.52	0.27	0.10

4.3.1.2.2 Repair and dysarthria severity. The process of repair varied across the dyads, according to the intelligibility of the participant's speech. The moderately and moderate-severely dysarthic participants had repair sequences that could be traced back to their speech deficits. In some instances, an absence of prosodic cues made non-literal meaning difficult to understand. Elsewhere, intelligibility was affected by dysarthric speech, leading to repair. Across the cohort, repair sequences were mostly successful, although there were examples of the conversation progressing without acknowledgement of a contribution by a participant. Three extracts will be presented, one from each of the dyads involving the moderate and moderate-severe participants (Niels, John and Rob). These extracts illustrate the impact of low volume, reduced intelligibility, and reduced prosody on the conversations of the speakers with moderate and moderate-severe dysarthria, and the consequent process of repair.

Extract 12.

Extract 12 was taken from the pre-intervention conversation between Niels and the researcher. In the conversation leading to Extract 12, Niels was telling a story from his young adulthood in Denmark, where beer was sold in wooden crates. The researcher followed-up with a question about the difference in Australian beer, and mistakenly asks about Dutch, rather than Danish, beer.

Extract 12: Niels (moderate dysarthria, pre-intervention)

1	**AE:**	**°hh so ha- dutch beer. does it vary much from australian beer? did you notice a difference**
2		**co(hh)ming ov(hh)er?**
3	(0.4)	
4	Niels:	°hh ah::. (0.5) the (danish)
5	(1.0)	
6	**AE:**	**the taste is different.**
7	Niels:	no, danish beer:s. (0.8) I'm from den-denmark.
8	(0.8)	
9	**AE:**	**danish b[eer:s.]**
10	Niels:	[you] yeah [you-] you said dutch.
11	**AE:**	**[yeah]**
12	(0.5)	
13	**AE:**	**°hhh oh SOrry, [I-]**
14	Niels:	[hh] hh=
15	**AE:**	**=you're right cause Dutch beers are Holland beers.**
16		
17	**AE:**	**[sorry,] I actually like [heineken] so that's probably me having a bit of a**
18	Niels:	[°hhhh] [hhh hhh]
19	**AE:**	**freudian flip there(.) I – I quite like a dutch [beer ((laughter))]**
	Niels:	[°hhhh oh well but a:,]
20	(0.8)	
21	Niels:	a: °hhh (0.3) very (well known) beer °here in::° australia n °hh pacific °hh i- is carlsberg.
22	(0.5)	
23	**AE:**	**↑oh yeah? I've I– oh – oh look a ↑Carlsberg beer. so that's (0.3) danish beer**
24		**[(laug]hter)**
25	Niels:	[yeah.]
26	(.)	

After the researcher's erroneous use of "Dutch", there was 0.4 seconds of silence, before Niels started his turn at line 4 with an audible inspiration and filled pause. Niels then initiated and executed a repair, providing the correct term ("the Danish"). This repair was reduced in intelligibility, as indicated by the word "Danish" appearing in brackets in the transcription. In line 6, the researcher offered an interpretation of what she had decoded from Niels's turn, that "the taste is different". The word "taste" was stressed, an indication that the researcher was seeking confirmation that this particular word was correct. In line 7, Niels rejected the interpretation with "no" and then restated and rephrased his turn – "Danish beers", stressing the word "Danish". The researcher did not immediately respond, and there was an extended period of silence (0.8 seconds). Consequently, Niels offered a

further explanation as to why the interpretation was wrong, that he was "from Denmark". In line 9, the researcher repeated Niels's repair from line 7 "Danish beers", which indicated that the repair attempt was intelligible. There was no indication, however, that the researcher understood where the initial trouble had occurred. Niels commenced his turn during the terminal word of the researcher's turn, and in line 10, explicitly drew the researcher's attention to the trouble source "you said Dutch". The researcher's response in line 15 ("You're right because Dutch beers are Holland beers") confirmed that the repair was successful, and that the researcher understood the nature of the trouble – that the adjective "Dutch" related to the Netherlands. This repair sequence was increased in complexity due to the reduced intelligibility of Niels's first attempt at repair in line 4.

Extract 13

Extract 13 is from the conversational dyad involving John. The extract was taken from the data collected before John completed Loud and Proud. Just prior to this example, John's wife, Sal, and their dog, had entered the room, so that Sal could give the researcher a completed questionnaire. In this extract, John exhibited repair behaviour for talk that was mistakenly interpreted by his listeners as non-serious.

Extract 13: John (moderate-severe dysarthria, pre-intervention)

1	**AE:**	**So john¿ (.) do you remember getting ↑this one? (0.4) hhm (.) °hh ↓what's your memory of getting, rover.**
2	**(1.3)**	
3	John:	oh:::: ye:s:. (1.3) my daughter went down to mt i:sa.
4	**AE:**	**mm mm¿**
5	(0.9)	
6	John:	a:nd ah:, (0.4) °what.° (1.2) (their own dog,) and another dog. this thing. (1.1) and I:: (sort of flied to be there
7		and stayed about three to four) day:::s (0.8) an:d ah:::, she said to me, she said. (0.7) wouldn't you (love
8		having) this little dog¿ and I said nah:::::.
9	**AE:**	**((laugh [t er))]**
10	John:	[I said,]
11	(0.5)	
12	John:	I've got enough problems without [adding to them,]
13	**AE:**	**[hh hh hh hh] hh hh hh hh hh**
14	John:	(I don't think) your mother¿ (1.0) (I said I would just) trip over the bloody thing yes.
15	(0.5)	
16	**AE:**	**°↓yeah, that's true. That's actually something to be a bit careful abo[ut.]**
17	*Sal:*	*[yeah,] we do.*
18		*[I stood on the poor thing last night.]*
19	John:	[yeah. (so I thought) so I said, no ::]
20	(0.3)	
21	*Sal:*	*first time I've done it.*
22	John:	°hhh so I said, no thank¿ you.
23	(.)	
24	**AE:**	**((quiet laugh))**
25	**(0.4)**	
26	John:	and, um. (.) when (sal come), she said, (1.3) ((louder)) why don't you want the dog I said. (0.8) I've got
27		nothing against the dog ((dim)) I said (0.3) (it's just) you.
28	**AE *Sal*:**	**((laugh))**
29	(.)	
30	John:	°hhh you got so much on now:::. =
31	**AE:**	**=↓mm.**
32	**(1.1)**	
33	John:	and Ah (1.6) I (said) , (1.6) if we were:: (°to get it°) it's your °responsibility°. it's your. (0.5) you pay for it you
34		look after it °and you° (1.1) do what- do what it nee::ds.

In line 3 and lines 6 to 8, John commenced his story about how he came to own his dog. There were instances of speech that were difficult to transcribe, and the transcribers' attempts were included in the transcription within brackets. John recounted his response when his daughter suggested he would love having the little dog. In line 9, the researcher laughed, suggesting she found his reply to his daughter ("nah") to be humorous. John

continued his turn at line 13, with a common Australian saying "I've got enough problems without adding to them". The researcher again laughed which suggested the continued response was also interpreted by her to be humorous. There was, however, no prosodic cue to indicate that the comment was intended to be non-serious. At line 15, John explained further. There was reduced speech intelligibility at the beginning of line 15, when John introduced his wife as a reason not to get the dog. John repaired within his turn, changing his response at the word "mother". Instead, he introduced a concern that he could trip over the dog. After a 0.5 second pause, the researcher confirmed agreement regarding risk of falling. The researcher's response was spoken in a lower vocal register, and with a softer voice, confirming the talk was now interpreted as serious, rather than non-serious.

At line 17, John's wife, Sal, entered the conversation, to contribute a story about recently standing on the dog. John overlapped Sal at line 19, at a logical point for her turn to end (after "yeah, we do"). In conversations between typical speakers, overlap often occurs at a "transition relevant place" – a point where an utterance is syntactically complete. There was an extended period of overlap of John and Sal's speech at lines 18 and 19. Both John and Sal completed their utterances. Sal took the next turn at 21. John initiated repair at line 22, and rephrased and restated his overlapped talk from line 19 ("so I said no thank you"). Again, the researcher laughed at his reported refusal to take the dog from his daughter. John proceeded to describe his consequent discussion with his wife about why he didn't want the dog. Both the researcher and Sal laughed after John's statement that "I've got nothing against the dog, it's just you". John provided more detail at line 30, explaining that he told his wife that she had too "much on". The researcher acknowledged the serious nature of the talk with "mm mm", again with a lower vocal register. In his next turn, John described further his discussion with his wife about the consequences of taking the dog to their home.

Extract 14

The next extract was taken from the pre-intervention conversation involving Rob, the other participant in the cohort with moderately-severe dysarthria. Rob's speech was characterised by a very soft voice, rapid rate of speech, and episodes of pallilalia. In this extract, there were periods of noticeably quieter speech. Prior to this sequence, Rob and the researcher had been discussing Rob's son, who was recuperating after injuring his leg.

Extract 14: Rob (moderate-severe dysarthria, pre-intervention)

1	Rob:	= on the d::ay and he was supposed to stay ((dim)) there but, °hhh saw a snake, so he
2		got rid of the snake, so he rang up °°(>everyone you know<)°° and said come and get
3		rid of the snake instead of going home. °hhh so he's here now.
4		((l[a u g h s))]
5	**AE:**	**[°HH o(hh)h so] you've got your son recuperating? her[e.]** ←
6	Rob:	((creak)) [ye]ah. °°so he came
7		home, he came home, back and got a snake. °° (.) >(at least)< he's got today off so he's
8		got to go back (.) by tomorrow.
9	(0.3)	
10	**AE:**	**°hh s[o] ^has he got to head to lismore? tomorrow.=** ←
11	Rob:	[so]
12	Rob:	=°° ((creaky)) no he drives, he ((dim)) drives there tomorrow. (.) °°°for about °two
13		and a half hours (two [and a half])
14	**AE:**	**[°oh, gee.°]**
15	**AE:**	**yeah:. when he's just recovered.**
16	Rob:	°°°just recovered, yeah. it's a bloody long way it's long way
17		=it's long long wa[y .]

In line 1, Rob was telling the story of why he had his son staying at his home. Rob's speech was typically very soft, and in line one, the transcription showed that his speech became softer, to the point of being very soft and hard to transcribe at "rang up". The next bracketed phrase was the transcribers' best attempt at dictation.

At line 5, the researcher offered a summary of Rob's previous turn to be verified, that the son was recuperating at Rob's home. This was confirmed by Rob in his next turn, with additional information about the son's travel plans. This additional information was again confirmed by the researcher, by way of her seeking verification of the destination and date of the son's travel home. Although Rob commenced his turn with "no", the interpretation was confirmed, that the son was driving to Lismore the following day.

The dyads in this study were efficient in resolving misunderstandings brought about by reduced intelligibility or understandability. However, there were two examples in the corpus where reduced intelligibility and understandability resulted in the contribution of a participant being lost from the conversation. An example of the deletion of a participant's turn is provided in the next extract.

Extract 15

In the conversation leading to Extract 15, the researcher and Rob had been discussing the local process of tertiary entrance. The researcher and Rob's children had progressed through this system in their final year of secondary education.

Extract 15: Rob (moderate-severe dysarthria, post-intervention)

1	**AE:**	**°yeah.° ^ I think I- ((*f*))↓ I remember when ((*f*)) it came in and the person who**
2		**(0.2) you would- (0.2) probably remember more than this,**
3	Rob	([°oh yeah. mike tower.])
4	**AE:**	**[but the thing that really stuck with me]**
5		**(0.3)**
6	Rob	(°mike tower.)
7		(0.3)
8	**AE:**	**((*f*)) yeah. ((end *f*)) and (.) th they said, (0.6) um:, °hh the::: (0.2) the problem**
9		**with the system is you can't make a s::imple system that's fair,**
10		**(0.5)**
11	Rob:	yea[h.]
12	**AE:**	**[s]o it has to be (.) compli[cated.]**
13	Rob:	[cated,] yeah. (0.8) we::ll::: (the kids, all) they
14		can do is on the day they do the exam is do the best they can.
15		(0.3)
16	**AE:**	**°yeah th[at's exactly ri:ght.]**
17	Rob:	([which makes a differen]ce to those (.) kids. (.) those, °°kids who- °°)
18		(.) kids that muck up a lot of the time if they do ((dim)) well in the exam, that's
19		°°good.

In line 1, the researcher commenced telling the story of meeting one of the tertiary system's developers, soon after its implementation. The researcher interrupted her anecdote to suggest that Rob would remember more about "this". At lines 3 and 4 there was overlapped talk between Rob and the researcher. Rob's contribution of a name at line 3 was softer than his usual soft speech, and was difficult to transcribe. The researcher paused after her first phrase, at a time when her turn was incomplete, and without a prosodic cue that she would continue. This allowed Rob to initiate a repair, following the

reduced intelligibility of his overlapped speech at line 3. Rob took the opportunity to repeat his overlapped turn; his speech remained soft, and difficult to transcribe. At line 8, the researcher's turn was dysfluent. She continued the anecdote she had been relating at lines 1 to 4, without acknowledging Rob's contribution of Mike Tower's name.

The dyads' repair behaviours changed with the severity of the participants' dysarthria, and before and after Loud and Proud. The potential influences that led to the decrease in other-initiate repair, and the influence of intelligibility on repair behaviour with increasing dysarthria severity, are considered in the discussion, below.

4.4 Discussion

In this Phase I study, mixed methods were used to examine the conversational behaviours of people with PD and an expert communication partner. The PD participants had differing severity of motor speech symptoms, and data was collected before and after group therapy. The combined use of CA and descriptive statistics enhanced the trustworthiness of the methodology. [319]

4.4.1 Participant contribution to the conversation

Group therapy has previously been shown to positively influence pragmatics, and particularly initiation, for people with PD. [152] This is consistent with the current study's finding of increased topic setting and contribution to conversations by the participants following the Loud and Proud intervention.

4.4.1.1 Participant contribution to the conversation before and after therapy. As discussed in Chapter 2, Section 2.2.5.1, conversational competence was a primary behavioural change targeted during the Loud and Proud intervention. The increased participation apparent in the data set by the people with PD following the intervention, as illustrated by the examples, is therefore a promising indication that therapy may have influence on conversations in the home environment. However, the initial conversations were the second time the researcher had met each of the participants, and the final conversation was the fourth meeting. An increase in familiarity may have influenced the findings. The researcher's behaviour was responsive to the participants' ability to contribute to the conversations, and is discussed below.

4.4.1.2 Researcher behaviour. The researcher's tendency to overlap less frequently than the person with PD, to concede her turn on overlap, and to tolerate silence may reflect accommodation to the participants' communication impairment. Additionally, these behaviours are likely to be influenced by the researcher's experience as a speech-

language pathologist. The importance of the communication partner's behaviours has been previously described by Mirenda and Donnellan [320] Children with severe communication impairments contributed a greater proportion of topics to conversations with adults that adopted a facilitative approach. [320] Similarly, the researcher in the current study exhibited less competitive behaviour for turns and tended to yield her turn on overlap. These behaviours were frequently observed during participant-initiated topic changes after the intervention. The researcher also exhibited a high tolerance for silence, which may have further reduced the instance of overlapping speech. Tolerance for silence is not typically seen in the conversations of people without communication disorder. [175] The researcher's influence in supporting the contribution of the participants was unsurprising given the training that speech-language pathologists receive in facilitating turn-taking for people with communication disorders. [301]

Griffiths and colleagues [182] found that people with PD were observed to overlap in the middle of the conversational partner's turn. Speech initiation difficulties and cognitive slowing were put forward as possible explanations. [182] Overlap was reported to be problematic for PD speakers in conversation, [182] resulting in an increase in the need for repair, and at times, the loss of the person's contribution to the conversation. In this data set, overlap and its consequences were variable, particularly amongst the more severely dysarthric participants' dyads. The two participants with moderate-severe dysarthria are a case in point. After the intervention, the researcher demonstrated a tolerance of silence in John's turns. John offered a series of lengthy anecdotes, and the resulting conversation was monologue in nature. In contrast, the researcher did not wait for Rob's contributions and, at times, competed with him for the turn. Despite the very different nature of the conversations, both Rob and John demonstrated the ability to increase their contribution of topics to their post-therapy conversations.

Given Rob's success, avoiding overlap is not necessarily a target for all dyads involving people with PD. Potentially, the skills that result in successful competitive overlap may be targets for intervention, so that people with PD can learn to break into group conversations. Successful competitive overlap behaviour may assist people with PD to gain the turn. To further increase success, targeting listening and facilitation skills in primary conversation partners is indicated. The findings underscore the importance of a focus on the two-way nature of conversations when planning intervention.

Further investigation of the influence of communication partners' behaviour on the participation of people with PD in conversation is warranted. Insights may be gained to inform the development of communication partner training in PD. A recent pilot study[143]

investigated the use of an adapted version of Supporting Partners of People with Aphasia in Relationships and Communication, [321] adapted for use with people with PD. The results of this trial were equivocal. Pairing impairment based intervention for the person with PD alongside conversational coaching with the primary communication partner invites further investigation.

Additional research is required to determine the impact of group therapy on the conversation of people with PD and their usual communication partners. Investigation of facilitative and obstructive behaviours of communication partners is warranted, to provide guidance for clinicians and families of people with PD.

4.4.2 Repair.

Repairs were classified according to the initiator and executor of repair, as previously implemented by Rutter [300] Reviewing the examples of repair, as classified according to self- versus other-initiated repair was informative about the communication behaviours of the current study's dyads.

Repair behaviour by the PD participants and the researcher followed the preferences previously reported for the interactions between speakers without communication disability. [315,322,323] Repair was most frequently initiated and undertaken by the speaker of the trouble source. Rutter [300] noted the same preference for conversational dyads involving a person with dysarthria as a result of multiple sclerosis.

4.4.2.1 Repair before and after therapy. The initiation of repair by a communication partner can be undertaken in a range of formats that reflect the amount of information a recipient has been able to understand. [315,317,322] When nothing of the trouble source is understood, a recipient may respond with an open class initiation of repair, such as "pardon?" or "huh?" [324] When an aspect of the trouble source is not understood, the recipient may repeat the part of the talk that was understood, or ask specific information such as "who?" or "what?" [315] The strongest claim to understanding is offering a candidate understanding – providing an interpretation of the preceding talk as a way of indicating understanding, subject to confirmation from the speaker. [315,317]

There was a uniform presence of candidate understanding from the researcher, prior to group therapy. It has been suggested that providing an interpretation of what has been said for confirmation by the previous speaker threatens the progress of the talk and interrupts the sequence that is being built. [317,325] In this study, an evident pattern was that the researcher offered candidate understanding in the conversations with speakers of all dysarthria severities prior to intervention. While the presence of candidate understanding does occur in the talk of speakers without communication disability, [315,317] people with PD

may be at increased risk of misunderstanding. Reduced understanding by the communication partner can occur due to reduced prosody, speech intelligibility, or cognitive-linguistic and theory of mind deficits, [100] which may result in key information being omitted. In the majority of instances, the researcher's use of a candidate understanding was followed by the person with PD repairing a trouble source. The Loud and Proud intervention targeted both intelligibility and understandability of the talk of the person with PD, through conversational practice and recalibration of loudness and effort. The reduction in candidate understanding post-therapy may be an indication of increased efficiency of conversation after group therapy.

4.4.2.2 Repair and dysarthria severity. Consistent with the findings of Griffiths et al., [182] the need for repair due to reduced speech intelligibility was present in this study's data set. Unsurprisingly, repair sequences that accompanied reduced intelligibility were associated with speakers with moderate or more severe dysarthria. Griffiths and colleagues [182] found that repair was not always successful, or completed, which resulted in the deletion of the turn from the person with PD. While not common, there were two examples within the current study's data set where PD participants' turns were repair processes failed, and the participant's contribution was effectively deleted. Although not a feature of this study, these examples provided further evidence of the susceptibility for the input from the person with PD to be lost in conversations. The most likely explanation for the infrequent occurrence of this pattern in this study are the strategies and experience of the speech-language pathologist researcher [301] and the optimal environment for communication. [158,212]

4.4.3 The use of mixed methods in analysis of conversation

The use of CA in this study provided information about conversations involving people with PD that would not have been illuminated by traditional testing or laboratory tasks. The turn by turn analysis of the contribution of both members of the conversational dyad uncovered the intersecting conversational behaviours of the researcher and participant.

The use of simple quantification provided complementary evidence relating to behaviours identified through CA. In particular, quantification of behaviours allowed comparison across participants and across time. [300,303,307] Graphical representation of behavioural counts allowed for the simultaneous illustration of a whole data set.

The approach to ensuring frequency counts are uniform for future research is a key consideration. [300] This study's methodology of providing a ratio of repair type per 100

words spoken provides a method that addresses changes in rate, participation and fluency within and across participants.

This study adds to the small number of reported studies that have utilised CA to describe communicative change following intervention. Similar to the studies by Boles, [301,303] which explored conversational change following communication therapy for people with aphasia and their primary communication partners, our participants demonstrated evidence of increased participation in conversation following intervention. Increased communication effectiveness for the participants with PD was evident through increased contribution of topics to the conversations.

4.4.4 Implications and Conclusions

As people with PD progress along the continuum of dysarthria severity, research and clinical practice must consider communication partner training. Potential skills may include teaching communication partners to scaffold conversations and accommodate for the dysarthria (by avoiding overlap and tolerating silence). Likewise, environmental adaptation (for example, reducing background noise) may assist people with PD.

There were multiple inter-related influences apparent within this small data set. The relationships between key conversational behaviours are illustrated in Figure 14 (below). Causality cannot necessarily be directly ascribed to co-occurring conversational patterns, and it is likely that the behaviours interact. Long term management of people with PD must be holistic in nature, and address both the impairment and conversational behaviours of the person with PD, as well as their communication partner communication skills. The disparity between the finding of increased participant contribution to conversations after therapy, and the participant and communication partner's experience of communicating, as described in Chapter 3 highlights the need to consider intervention for people with PD more broadly. This is especially true as the communication impairment increases.

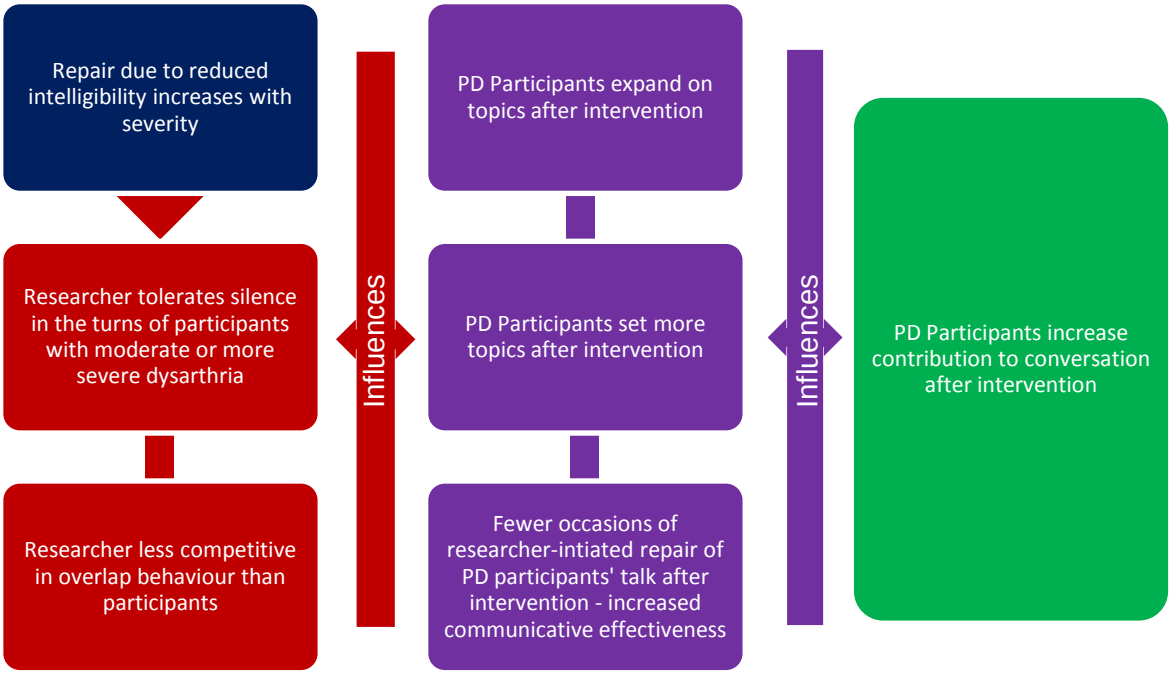


Figure 14: Patterns of conversational behaviours

The influence of PD on communication has predominantly been explored in the laboratory and clinic room setting. [157] This study has demonstrated the feasibility of using a mixed methods approach to describe conversation behaviour across participants and time from samples taken in the participants' own environments.

There were a number of limitations to the current study. This study aimed to explore conversation behaviour before and after group therapy across speakers with varying dysarthria severity. The small sample size, variability between dyads, and confounding influences of familiarity over time between the researcher (who was the constant communication partner) and the participants limit the ability to ascribe the behavioural changes observed to group therapy. [301] Additionally, these conversations were not naturally occurring. The clinical experience of the speech-language pathologist researcher was a likely influence on the conversational behaviours in the dyads, and further limits the generalizability of the findings to the naturalistic communicative environment. The use of a naive communication partner would have provided a natural communication environment for the participants, avoiding the confounding influence of the researcher's clinical skill. With the increased availability of portable recording devices, sampling natural conversations between participants with PD and their primary communication partners would be a valuable addition to future research protocols.

In this study, the conversations pre and post the group treatment were audio-recorded. Video-recording would have allowed analysis of behaviours such as gaze, gesture and facial expression. The lack of video-recording is seen as a limitation to this study. The conversational samples collected included an interaction with a health professional unfamiliar to the PD participants and as such were not typical everyday conversations. [326] The interview type structure of the earlier samples may have reflected an unequal perception of speaker rights between the participants, [326] although this was not intended by the researcher. To further explore the impact of group therapy on communication, it is recommended that future studies collect conversations between people with PD and familiar communication partners [291] and/or naive communication partners. Collecting data in dyads in quiet spaces removes some of the challenges reported by people with PD, such as background noise and distance between speakers. [143] The collection of data throughout the day may serve to illuminate these effects, especially for more mobile participants with milder dysarthria.

This study investigated the nature of conversations involving people with PD, according to the severity of dysarthria, and before and after intervention. The influence of cognitive-linguistic deficits was not explored in this study, and remains under-represented in the literature. [157] Future studies should include cognitive-linguistic measures and further examine the impact of cognitive-linguistic changes on the conversation behaviour of people with PD across the course of the disease. This study stratified participants by motor speech severity; it would be of interest to compare participants with varying degrees of cognitive-linguistic ability in relation to contribution to conversation, and overlap and repair behaviour.

This study contributes to the existing literature regarding conversational interactions involving people with communication disability, and in particular, the ways in which overlapping speech, conversational repair, and topic setting is managed by conversational partners. [182,288,327,328] Future studies are indicated to investigate the change in communication post-intervention in the naturalistic environment, with familiar and lay conversation partners, and in group discussions. Hybrid treatment approaches, incorporating impairment and functional approaches, involving both the person with PD and their communication partners, are required. The influences of cognition and communication partner behaviour on communication success should also be explored further.

5. Conclusion

The majority of people with PD will experience communication disability, that increases in severity, as the disease progresses. As such, people with PD and their speech-language pathologists must plan to manage communication for the remaining lifespan. At the time of this research, the literature provided strong evidence for the primary intervention for dysarthria in PD. The LSVT LOUD® was established as an effective treatment for improving speech in PD (Ramig, Fox, & Sapir, 2008; Sapir, Ramig, & Fox, 2011). However, there was limited research on the impact of intervention on the person's communication in their everyday environment, or the best ways to manage increasingly impaired communication across the course of PD. The aim of this research was to pilot a theoretically based group therapy intervention for the maintenance of speech following the LSVT LOUD®.

At the commencement of these studies, there was no known published intervention program for people with PD that sought to maintain their speech after completing LSVT LOUD®. Chapter 2 described the development of Loud and Proud, a group therapy approach for speech maintenance after the LSVT LOUD®. [23,149,152] Loud and Proud was created in accordance with the current best practice in neurorehabilitation, and was based on the principles of neuroplasticity and motor learning. In addition, Loud and Proud was designed to fit within a broader Chronic Disease Self Management framework, and targeted the participants' self-efficacy. Two pilot studies were undertaken to investigate the impact of Loud and Proud on maintenance of speech and communication in people with PD and describe the outcomes from this intervention.

5.1 Study I

Chapter 3 described an investigation of the impact of Loud and Proud on acoustic and perceptual measures of the participants' speech, communicative effectiveness and quality of life. While there were statistically significant improvements in SPL after the intervention, the participants' vocal loudness remained lower than that of the normal population. Consistent with this finding, participants did not demonstrate significant improvements on perceptual assessment of speech, communicative effectiveness, or quality of life measures. It was noted that there was considerable heterogeneity amongst the participants' with respect to their response to intervention. In order to address the sub-optimal outcomes from this intervention, several recommendations for the refinement of

Loud and Proud were provided. It was recommended that the intervention dosage should be increased to two days per week (eight sessions over four weeks), with an associated increase in activity in the home program. In addition, it was suggested that the Loud and Proud program be revised to include published boardgames to replace two activities that proved unsuitable in the pilot. It was also recommended that the assessment protocol be revised to include a more dysarthria-specific impact measure (The Dysarthria Impact Profile) [281] in future studies to determine the psychosocial impact of the participants' dysarthria. Further research involving larger controlled studies is required to determine the efficacy, and ultimately the effectiveness, of the refined Loud and Proud program in the real-world environment.

5.2 Study II

Chapter 4 investigated the conversational behaviour of subset of participants from Study 1 prior to, and following, Loud and Proud. A mixed-methodology was employed, driven by conversation analysis (CA), and incorporating descriptive counts of behaviours of interest. The inductive nature of CA was considered critical due to the exploratory nature of this research. The analyses commenced with CA, and quantification was then used to describe the identified behaviours before and after intervention and across the cohort. The mixed-methods approach revealed changes in the conversational behaviour of the dyad after intervention, and the differences within conversations involving participants with varying severity of dysarthria.

After the intervention, the participants with PD became more active in directing the topic for the conversations, and the need for researcher-initiated repair reduced. This finding was in contrast to the lack of effect of Loud and Proud on quality of life and communicative effectiveness as described in Chapter 3. The analysis enabled the behaviour of the researcher, who acted as the communication partner in the conversations, to be considered, through examination of the collaborative nature of the conversation between the person with PD and the researcher. Analysis of the transcripts revealed that the researcher demonstrated a high tolerance of silence in conversations with more severely affected participants, and was more likely to relinquish her turn when there was competition for the "floor". The presence of repair sequences related to the occurrence of unintelligible speech was apparent in the conversations involving participants with moderate or more severe dysarthria, but not in the conversations involving participants with mild or mild-moderate dysarthria.

Methodological issues were addressed in this pilot study. By use of CA as the primary method, the benefits of the inductive nature of CA were not lost in quantification.

This was particularly important as little was known about the impact of maintenance interventions on communication in PD. The process of standardisation of counts was also addressed in this pilot study. Refinements to the protocol were recommended for future studies. A primary recommendation was the use of video-recorded samples of conversation in future studies, to allow assessment of non-verbal behaviours such as facial expression, gesture and gaze, which are particularly important factors in communication with people with PD. The collection of conversational data involving familiar and/or naive communication partners was also suggested, to explore conversation as experienced by people with PD everyday. This pilot study has demonstrated the sensitivity of CA in describing features of conversational behaviour, that might otherwise remain obscured. The usefulness of quantification to describe differences across time and between participants was also demonstrated.

5.3 Clinical Implications and Future Directions

This research provided important information for clinicians about the next step in managing communication in PD, after intensive behavioural therapy. The research revealed that Loud and Proud group therapy holds promise in the management of communication in PD. Increases in SPL were made for some participants with PD after the intervention. There were also positive changes in communicative behaviour in conversations with a researcher. However, there was a variable response to Loud and Proud, and participants did not substantially improve in intelligibility, communicative effectiveness, or in their quality of life. As such, Loud and Proud requires refinement, and should be considered as part of a broader management program for communication in PD.

The contrast between the qualitative and quantitative findings poses a conundrum, particularly the lack of impact of Loud and Proud on self-rated quality of life and communication-partner ratings of communicative effectiveness. The disparity between performance when speaking with the researcher, an expert listener, and perceptions of ability in the home environment may reflect unrealised potential for the participants with PD. It may be that treating the person with PD alone is insufficient, particularly as the dysarthria becomes more severe. Future research should investigate conversations between people with PD and their communication partners, to determine the behaviours of each conversationalist that facilitate or hinder the person with PD's contribution to the conversation. A hybrid program of behavioural intervention for the person with PD, along with communication partner training, should also be trialled. This dual approach for people with PD may provide conversational changes similar to that reported in Chapter 4.

To the author's knowledge, this was the first description of a maintenance program specifically designed to follow on from the LSVT LOUD®. Initial efficacy data were presented, and refinements to the program and research protocol were determined. While the increase in SPL following Loud and Proud suggested that a group therapy program has promise as a maintenance strategy, Loud and Proud was not effective in impacting on the participants' self-rating of quality of life, or communicative effectiveness as assessed by their primary communication partners. The disparity between the qualitative findings in the conversational behaviours and the quantitative outcomes of quality of life and communicative effectiveness require further consideration.

5.4 Limitations

This research was a pilot study to investigate the outcomes of group therapy as a maintenance approach after the LSVT LOUD®. The results cannot be generalised due to the small sample size. Areas for improvement were identified both for the group program, and the research design. Additional Phase I research is required to assess the efficacy of the revised program, prior to expansion of the research to larger participant numbers and randomised control trials.

An additional limitation of this study was its scope. Being a small, Phase I study, this research primarily targeted and investigated motor speech. Given the known cognitive-linguistic deficits in PD and their likely impact on interaction, future research should investigate the influence of therapy on cognitive-linguistic ability, as well as the influence of cognition on behavioural intervention.

5.5 Future Directions for Research

The studies reported in this thesis were small in scale, as is appropriate for Phase I research. [260] As a result of this preliminary pilot, a number of revisions have been suggested to the Loud and Proud intervention. The program now requires Phase II research to:

- establish the optimal dose of the intervention,
- explore likely influences in treatment response,
- ensure the assessment protocol is valid and reliable,
- gather further efficacy data,
- and to determine whether Phase III research is warranted. [260]

5.5.1 Establish optimal dose. In the next study, the collection of follow up data is required, in preparation for larger scale research into the treatment's efficacy. Data is required regarding the outcomes of Loud and Proud at six and 12 months post-intervention to provide evidence regarding the longer term effects and carryover of the intervention.

5.5.2 Explore likely influences in treatment response. The design of larger scale research into Loud and Proud should include analyses of potential causes of heterogeneity in treatment response. Analysing data according to time post-LSVT LOUD® would assist in exploring the effect of the timing of maintenance. It is possible that if maintenance therapy is provided too late, the effects of the LSVT LOUD® may have worn off, limiting the effectiveness of Loud and Proud. Similarly, analysis of the influence of time post-diagnosis of PD and severity of PD should be included in the design of larger scale studies to determine the effects of disease duration and severity and duration on treatment response.

5.5.3 Ensure assessment protocol is valid and reliable. Following this pilot research, it was recommended that the QCL be replaced with a measure more specific to dysarthria. Additionally, cognitive linguistic measures have been recommenced for future studies. The validity and reliability of the assessment battery must now be established in the context of these changes.

5.5.4 Gather further efficacy data. Following this pilot study, larger scale studies are warranted, including collection of initial control group data. Larger scale studies would also allow for the use of statistics to further describe the behavioural changes in conversation following group therapy as detailed in Chapter 4. This pilot study has described emerging patterns of behaviour that could be explored in further studies using qualitative analyses: topic initiation and participation in conversation, use of competitive overlap, and instances of repair. A methodology for making the counts of these behaviours uniform was described, and could be applied to future studies to allow comparison between participants and before and after intervention.

5.5.5 Determine whether Phase III research is warranted. Phase III research establishes the efficacy of an intervention by way of clinical trial [260] Phase II research is required to determine whether a large scale clinical trial of Loud and Proud is justified.

5.6 Conclusions

In conclusion, this research provided preliminary efficacy data for Loud and Proud, a group therapy program for people living with PD. The results indicated that Loud and Proud has potential to assist in maintaining the speech outcomes following the LSVT LOUD®. The effects of Loud and Proud on the communicative interactions of the

participants were also described. The participant's contribution to the direction of conversation and repair behaviour were changed in conversations after the intervention. The communication partner's related conversational behaviours were described.

Communication maintenance of the person with PD should consider all domains of the International Classification Framework (Threats, 2008; World Health Organization, 2001), and plan for the long term. With refinement and further research, it is anticipated that Loud and Proud will assist people with PD and their clinicians in their quest to maintain communication.

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Appendices

Appendix A: Ethical Approval
Appendix B: Content of Flyer for Recruitment of People with PD
Appendix C: Example Loud and Proud Workbook Pages
Appendix D: Transcription Conventions

Appendices

Appendix A: Ethical Approval

THE UNIVERSITY OF QUEENSLAND

Institutional Approval Form For Experiments On Humans Including Behavioural Research

Chief Investigator:	Ms Ann Edwards
Project Title:	Functional Communication Outcomes Of A Group Speech Maintenance Program For People With Parkinson's Disease (PD) - 22/11/2007 - AMENDMENT
Supervisor:	Associate Professor Deborah Theodoros, Dr Bronwyn Davidson
Co-Investigator(s):	None
Department(s):	School of Health and Rehabilitation Sciences, Speech Pathology
Project Number:	2006000430
Granting Agency/Degree:	PhD, Queensland Health Community Rehabilitation Scholarship
Duration:	31st December 2010

Comments:

UQ MREC approval subject to approval from the Princess Alexandra Hospital HREC, and any other relevant approvals in respect to the additional sites.

Name of responsible Committee:-
Medical Research Ethics Committee
This project complies with the provisions contained in the *National Statement on Ethical Conduct in Research Involving Humans* and complies with the regulations governing experimentation on humans.

Name of Ethics Committee representative:-
Professor Bill Vicenzino
Chairperson
Medical Research Ethics Committee

Date: 4/12/07 Signature:

THE UNIVERSITY OF QUEENSLAND

Institutional Approval Form For Experiments On Humans Including Behavioural Research

Chief Investigator:	Ms Ann-Marie Edwards
Project Title:	Functional Outcomes Of A Group Speech Maintenance Program For People With Parkinson's Disease (PD) - 20/04/2012 - AMENDMENT
Supervisor:	Prof Deborah Theodoros, A/Prof Bronwyn Davidson
Co-Investigator(s):	None
Department(s):	School of Health and Rehabilitation Sciences, Speech Pathology; Dept of Speech Pathology and Audiology, University of Melbourne
Project Number:	2006000430
Granting Agency/Degree:	PhD
Duration:	31st December 2014

Comments:

Name of responsible Committee:-
Medical Research Ethics Committee
This project complies with the provisions contained in the *National Statement on Ethical Conduct in Human Research* and complies with the regulations governing experimentation on humans.

Name of Ethics Committee representative:-
Professor Bill Vicenzino
Chairperson
Medical Research Ethics Committee

Date: 24/4/2012 Signature:

Appendix B: Content of Flyer for Recruitment of People with PD

Have you completed the Lee Silverman Voice Treatment (LSVT)?

Are you interested in maintaining your speech and voice?

Researchers from Queensland Health and The University of Queensland are looking for volunteers to participate in a research study investigating the use of group therapy to maintain speech and voice following the LSVT®, with sites in Brisbane and the Gold Coast.

Appendix C: Example Loud and Proud Workbook Pages

Week Three:

Task	Effort (out of 10)	Success Rating	Aim
Last Week's Take Home Task			
Loud 'ah'			
High			
Low			
Phrases			
Conversation			
Reading			
Activity			

Effort…

- 10 = Whew, that took it out of me! I've got nothing left!
- 8 = Working consistently hard!
- 6 = I'm working hard most of the time (but slip a little)
- 4 = I could do better
- 2 = I could definitely do a lot better
- 0 = I'm napping…

Success…

- Perfect
- Excellent
- Good
- OK
- Pretty ordinary
- Needs work

Aim for next week…

- Keep it up
- A little better
- A lot better

Take Home Task…

Where I'm going to use my best communication and greatest effort this week…

Appendices

Week Four:

Task	Effort (out of 10)	Success Rating	Aim
Last Week's Take Home Task			
Loud 'ah'			
High			
Low			
Phrases			
Conversation			
Reading			
Activity			

Effort…

- 10 = Whew, that took it out of me! I've got nothing left!
- 8 = Working consistently hard!
- 6 = I'm working hard most of the time (but slip a little)
- 4 = I could do better
- 2 = I could definitely do a lot better
- 0 = I'm napping…

Success…

- Perfect
- Excellent
- Good
- OK
- Pretty ordinary
- Needs work

LSVT Home Practice Done???

Aim for next week…

- Keep it up
- A little better
- A lot better

Take Home Task…

Where I'm going to use my best communication and greatest effort this week…

Appendices

Appendix D: Transcription Conventions

[	Left square brackets indicate a point of overlap by different speakers
]	Right square brackets indicate the point at which overlapping ends - either both end of where one ends while the other continues
=	Equal signs indicate an absence of pause between talk, either a continuation of talk from one speaker, or no discernible space between the speech of different speakers
(0.5)	Numbers in parentheses indicate silence 0.2 seconds or greater, rounded to the nearest tenth of a second
(.)	A dot in parentheses is a discernible pause less than 0.2 seconds
.	Falling intonation contour
?	Rising intonation contour
,	Continuing intonation (rising)
¿	Rising intonation contour, stronger than the comma, but weaker than the question mark
::	Stretching of the preceding sound
-	Talk is cut off or self interrupted
word	Emphasis (either with loudness or pitch) - the more underlining, the greater the emphasis
WOrd	Stronger emphasis than underlining
°	Talk that is softer than surrounding talk. Can be used in pairs to bracket soft talk.
°°	Talk is markedly soft
°°°	Talk is whispered
((f))	talk is louder than surrounding talk
dim	Talk that becomes softer
cresc	Talk that becomes louder
_:	Falling intonation contour on the preceding vowel
:	Rising intonation contour on the preceding vowel
↑↓	Sharper rises or falls in pitch than indicated by colon and underlining combinations. May be a change in register.
> <	Talk within is compressed or rushed
< >	Talk within is stretched or slowed
accel	Talk gets faster
<	Talk preceding starts is “jump-started” or starts with a rush

hhh	Audible aspiration (e.g. breathing or laughter) - the more h's the longer the aspiration
°hhh	Audible inspiration
(( ))	Transcriber's description of events
( )	Transcriber is uncertain of transcription within. If empty - transcription was not possible

Transcription convention adapted from Sidnell [175] and Müller [313]